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EDITORIALS

IMAGINATION IN ENGINEERING.

Engineering is based upon mechanics. The civil engineer is concerned largely with statics, the mechanical engineer with dynamics, the electrical engineer with electrodynamics, and so on. The field of each overlaps to some extent that of the others. But the function of the engineer is not fulfilled by the mere application of his knowledge of physics or chemistry. To do his best work and do it well he must combine with his engineering knowledge the esthetic sense of the artist and the imagination of the architect. He must not only create new things or lay out the plans for creating them, but he should make them as beautiful as possible, make them fit their surroundings and use. He must also be able to conceive of things which have not existed before.

In this sense the draftsman who lays out on paper a slight variation from some previous design, modified only enough to fit altered conditions, or the computer who calculates the necessary size of members from established formulas, or the man who brings together a number of units each of which is regularly used in different combinations, is not truly an engineer. The man who combines the ability to do these things with the vision and the imagination to conceive of ways and methods for accomplishing the things which cannot be done by ordinary methods, and who can carry out these ideas to a beautiful realization, is the true engineer. He it is who does new things, or does old things in a new way, who increases efficiency and eliminates waste, who gets results which were not previously attained. Examples of such ability are seen in Roebling, of Brooklyn Bridge fame; in Ferris, who constructed the big amusement wheel; and in the Wright aviators. Examples among electrical men are legion, as nearly every well known electrical inventor has shown vision of this kind as well as engineering knowledge. Imagination must precede realization, and real engineering involves conception as well as construction.

Some of the earlier efforts of engineers were devoted almost wholly to getting things done, especially in the newer parts of the country, where development was sought and had not reached the point where esthetic elements received much attention. In older communities the artistic relationships of engineering structures receive more attention, and in comparison with them the others look raw and crude. The well rounded engineer will in all cases endeavor to make his creations objects of beauty which are in harmony with their surroundings, limiting his efforts in this direction only by the financial necessities of the situation.

FLEXIBLE CONTROL OF LIGHTING.

The greatest comfort and satisfaction to be obtained from electric lighting service in the home is frequently sacrificed by parsimony or negligence when the house is wired. The convenience of switching a hall light on or off from either the top or the bottom of a flight of stairs is generally recognized, and few residences are today wired without providing the two-way switches which will permit this. The many other cases in which such switches will prove equally advantageous are usually overlooked, or if considered the bugaboo of expense is permitted to interfere with their adoption. This is false economy, as the saving achieved is insignificant compared to the convenience that is sacrificed.

In many rooms with two doors a switch near each door will often save stumbling in the dark, and in bed rooms it is an advantage to have a switch within reach from the bed as well as one at the door. Porch lights might well be controlled from both outdoors and indoors. Many other applications of two-way switches will suggest themselves to the thoughtful planner. Unnecessary restriction in the flexibility of an installation is not only a detriment to that particular installation, but retards the dissemination of the full story of the convenience of electric service.

REDUCING ELECTRICAL FIRE HAZARDS.

Electrical circuits have been accused of being responsible for many fires which have had other origins difficult to determine. In this field it has to be a certain extent been made a scapegoat. It is true that some fires have actually been due to crossed wires, but not nearly so many as have been attributed to it. Those familiar with the use of electrical energy know that it is comparatively safe and it is to the interest of every one connected with the industry, and particularly of the central stations, to make this fact more widely known and at the same time to keep the hazards from the use of electricity just as small as possible, in order to increase the general favor in which this form of service is held by the general public. A good reputation is obtained and maintained by means of a good record and proper publicity for it.

There are a number of inevitable hazards connected with the use of electrical energy and every effort should be made to reduce these just as far as possible. Two that come to mind at the present time are due to the electric pressing iron and the starting boxes connected to small motors. The electric pressing iron is the cause

of an occasional fire through abuse or the carelessness of the person handling it. Conditions are in some cases unduly favorable to a fire from this cause. Most of the irons on the market will heat up to an unsafe temperature when left in circuit without being used, and as they may be attached to any lamp socket, there is usually no indication that forces itself upon one's attention to show whether they are receiving energy or not. It is a very easy thing for the person who is using an iron to go off and leave it connected to the circuit, due to hurry, interruption of work, or other cause of very frequent occurrence.

There are, of course, means for preventing the occurrence of conditions which may lead to a fire from this cause, but such methods usually involve expense, and it is an American habit to run almost any danger of fire in order to save a few dollars. This tendency is evident in building construction and in numerous other activities. Irons equipped with safety devices are sometimes less convenient and usually more expensive than irons not thus equipped, and as the customer does not usually recognize the importance of such protection, such irons do not find a ready market unless pushed by the dealer and the central station. Irons may be equipped with a pilot light for indicating when current is flowing, with a thermostat to automatically keep the temperature within safe limits, with a special switch which opens the circuit when pressure is taken off of the handle, or with an attached stand which automatically lifts the face of the iron away from the supporting surface when not in use. Any one of such devices may act as a fire preventive and certainly reduces the hazard, even though it does not, when out of order or improperly used, absolutely prevent a fire. Certainly, however, it is to the interest of central stations and dealers, in protecting the future reputation of electrical service, to encourage devices in which the fire hazard is lessened.

Many installations of starting boxes for small motors are so easily put out of order or are of such flimsy construction that they likewise may develop a fire hazard when not used under expert supervision. This applies especially to motors for household use or those utilized in small factories not provided with an electrician, such as small clothing shops.

A few small fires which have resulted from this cause in New York City have led the Department of Electrical Inspection to prohibit the use of any small motor-starting devices except of types which have been definitely approved by the Department. In discussing this question Mr. H. S. Wynkoop, electrical engineer for the city, stated that investigations made by the Department pointed very definitely to the need of following these precepts; (1) All live metal parts should be enclosed. (2) The rheostat should be designed so that it will be inoperative with the cover open. (3) Heat insulation should be placed between the motor and any wooden parts, such as a sewing-machine top. (4) Means should be provided rendering it impossible to start the motor when the brake is set. (5) Means should be provided for guarding against a broken retractile spring, so that the motor cannot accidentally be set to run at full speed.

Since sewing machines are especially likely to be surrounded with inflammable material, it is especially desirable to provide that current may not be left on when the machine is not in use. The influence of the central station or solicitor is often the deciding point in determining what equipment a customer will purchase. In realizing this influence they should use every endeavor to see that the equipment installed is as safe as it is possible to make it.

ETHICS IN ARCHITECTURE AND IN ENGINEERING.

The American Institute of Architects has included in its Canons of Ethics the statement that it is unprofessional for an architect to engage directly or indirectly in any of the building trades. So far as we know the members fully live up to this standard and there are probably very few architects outside the membership who contravene this canon. Its formulation is a recognition of the fact that the interests of owner and builder are at times antagonistic, and that if the architect is to fully and properly represent the owner in any dealing he should have no interest upon the other side. Builders have not so generally recognized this distinction and have frequently undertaken to do the architect's work in addition to their own, but in such cases do not generally pose as representing the owner's interest to the extent expected of an architect.

It is a legal maxim that no man can serve two masters. The idea is not fully carried out in commercial life. For example, it is not unusual for a real-estate broker who has arranged for an exchange of property to ask commissions from both parties. Legally, however, he is not presumed to be capable of acting as agent of both, and probably could not collect his fee by action at law in most of the states unless there was a definite agreement made beforehand providing for such fee.

In engineering work the consulting engineer occupies with respect to his client a position very similar to that of the architect. He designs and lays out the work, draws up the specifications, and sees that they are complied with, all in the interest of the owner. His relation to the owner is as advisor and agent. He cannot at the same time represent the contractor, in case there be any clash of interest. Yet many firms of engineers essay to carry out the work of both consultant and contractor. When this is not done by a single concern, it is frequently done by two corporations having common ownership, at least in part. In some cases this even extends to the point of combining the above activities with ownership or management of an industrial or utility corporation, so that two companies dominated by the same men actually make contracts with each other. While this may be done with honest motives and with no intention of manipulating affairs to the disadvantage of any minority interests, the pos-

sibility of such manipulation and fraud plainly exists, and at the best it is a case of opposing interests being represented by the same individual. It is conditions such as these that a code of ethics is supposed to cover. Is it not worth while for the national engineering societies to consider whether they should countenance such practice or whether it should be placed under the official ban?

The matter in question is not referred to in the Code of Ethics of the American Society of Civil Engineers. The Codes of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers regard full knowledge of the relationships as necessary and sufficient. They state that an engineer cannot honorably accept compensation from more than one interested party without the consent of all parties. Further, the engineer must not accept commissions, directly or indirectly, from parties dealing with his client or employer. The Code of the American Institute of Consulting Engineers designates as unprofessional the neglect of an engineer to inform his clients of any business connection which may be deemed as influencing his judgment or the quality of his services to his clients.

These pronouncements indicate that the danger of dual service has been recognized among engineers and its practice in secret has been condemned, but they have not yet taken the decided stand in the matter that has been assumed by the architects.

PROVIDING SPARE GENERATING CAPACITY.

A season of hard times or a season of high prices acts as a deterrent to electric utilities as to other companies and individuals in regard to the installation of new equipment. The one may make enlargement unnecessary and difficult to finance, while the other makes the time inappropriate. The central stations of this country during recent years have faced first the one condition and then the other, with the result that orders for new equipment in generating stations fell for a while far below the normal volume. The recent growth of new business has made it imperative for many plants to provide increased generating capacity in spite of the continuing high prices, since actual loads have crept up too close to the ultimate capacity of the power plant to leave a safe margin for contingencies. The conditions which central stations have faced have made it even more imperative than usual to consider and decide what margin or amount of spare capacity in the generating station is the most suitable to maintain.

Absolute insurance against breakdown or interruption to service cannot possibly be provided. The best that any management can do is to provide such a factor of safety that the danger of interruption to service is balanced against the financial cost of better protection. The amount of spare capacity which should be made available will depend upon many conditions, some of which are of an entirely local nature. The duration of the peak demand and the overload capacity of the machinery for short periods is one important factor and the availability of reserve storage batteries is another. Where two systems are connected together so that one may provide power to the other in case of an emergency it is obviously unnecessary to provide as much spare capacity as when a system is entirely isolated. Where a power station supplies circuits which are embraced in a single system the percentage of spare capacity need not be so high as where several different systems are operated and a margin is required for each. Again where a part of the load upon a station is of such a character that it may be disconnected in times of emergency without penalty to the operating company or without other objectionable results, it is again obvious that the margin of spare capacity may be reduced. The conditions in steam and hydraulic stations again are different, since the output of a steam station is limited solely by the capacity of the boiler plant and generating machinery, whereas in a hydraulic plant it may be limited by the seasonal flow of water.

The installation of large new turbogenerator units for reasons of efficiency and economy may result in the incidental provision of spare capacity in the form of older machines whose efficiency is too poor for regular use but which may be kept in reserve for emergencies. A development of this kind has resulted in the existence of adequate reserve capacity to meet all contingencies in the case of several modern powerhouse installations. On the other hand, where the new generating station to have modern equipment is being planned and constructed, the margin of spare capacity in the existing stations may fall to a very low value in the face of an increasing business, especially where unavoidable delays have been encountered, as has been the case in Cincinnati.

The general opinion of central-station engineers upon the provision of spare capacity is that a power plant should have sufficient equipment to carry the maximum load when the largest unit is out of service, since the occurrence of these two contingencies may be simultaneous. This results in making the percentage of spare capacity dependent upon the size of units and the aggregate load upon the station. An investigation of actual conditions in this country reveals the fact that the spare capacity in central-station plants varies all the way from 10 to 100 per cent of the maximum load.

Recent conditions in England have led to some very small margins of existing spare capacity for reasons somewhat similar to those which have been operative in this country. The production of munitions of war has enormously increased the demand for power made upon certain of the central stations, and at the same time financial considerations have made it undesirable to invest in new plant. The result is that the percentage of spare has been reduced to as low a value as nine per cent in Glasgow, as reported by Mr. W. W. Lackie, the electrical engineer, in a recent plea for authority to enlarge the plant.

Happenings in the Industry

Brooklyn Rate Order Modified—Final Decree in General Electric Tungsten-Lamp Case—To Contest Arbitrary Depreciation Ruling—Automobile Headlight Situation to Be Discussed—Speed Control of Induction Motors—December N. E. L. A. Meeting—H. L. Doherty Speaks in Kansas City—Extensive Work of Underwriters' Laboratories for 1916—Miscellaneous News

ORDER REDUCING BROOKLYN RATES MODIFIED.

Commission Investigates Objections of Company to Making General Reduction.

The Public Service Commission for the First District of New York has ordered a reduction from 11 cents to 8 cents per kilowatt-hour in the electric lighting rates of the Edison Electric Illuminating Company, of Brooklyn, with corresponding reduction in other rates, to take effect January 1, 1917. The Commission on October 27 issued an order directing the company to reduce its rates, beginning January 1 to a maximum of 8 cents per kilowatt-hour, to take effect for a period of one year, as a test. The company objected to several points in the finding of the Commission and applied for a rehearing. Conferences followed between the officials of the company and the Commission, as a result of which on December 22 the Commission granted the company a rehearing, at which the various objections which the company had to the Commission's order were voiced. Increased cost of materials and operating expenses were set forth as reasons why it should be practically impossible to accept the order as originally issued. The Commission thereupon agreed to make certain changes in the order. These changes, however, have no effect upon the rates of the smaller consumers who will obtain the benefit of the reduction from 11 to 8 cents. Unofficially, the Commission was informed that the company would in all probability accept the order as altered, and put the new rates into effect at the beginning of 1917.

FINAL DECREE IN GENERAL ELECTRIC COMPANY TUNGSTEN-LAMP CASE.

Decision Upholds Claims of General Electric Company and Damages of $95,000 Awarded.

Final decree was entered November 15, 1916, in the suit of the General Electric Company against the Laco-Philips Company of New York for infringement of the Just and Hanamann tungsten-filament lamp patent. Payment was made to the General Electric Company of approximately $95,000 on account of damages for infringement of this patent.

The bill of complaint in the case was filed by the General Electric Company in 1912. The suit was argued in the District Court, southern district of New York, November, 1915. Judge Mayer decided in favor of the General Electric Company in February, 1916. The case was appealed by the defendant and argued in the United States Circuit Court of Appeals in New York last May. This Court affirmed Judge Mayer's opinion in June and final decree was entered November 15, 1916.

One of the most interesting chapters in the romance of the electric light is disclosed in the opinion handed down by Judge Mayer reviewing this interesting case.

"In 1902 Messrs. Just and Hanamann were assistants to Professor Vortmann of the Technical Hochscule in Vienna," writes Judge Mayer, "and in August of that year Just, who was spending his spare time attempting to develop a boren incandescent lamp, engaged Hanamann as a chemist for that work. The work continued until the latter part of 1904, when the laboratory in which they were working was closed and the experimenting ended in failure.

"Meantime, however, these men conceived the idea of making an incandescent electric lamp with a filament of tungsten. Their means were limited, the income of one being a trifle under and of the other a trifle over the equivalent of $50 per month. But they perservered and, although one of their early attempts failed, they finally succeeded in producing a pure tungsten filament and filed their application for a British patent on November 4, 1904, and on the same day their application for a French patent. In this country, the application which resulted in the patent in suit was filed July 6, 1905.

"Prior to the introduction of the tungsten lamp here, Just and Hanamann in 1905 succeeded in having their invention taken up by a Hungarian factory and in the spring of 1906 the German rights were sold to a German corporation, and later the rights in the United States were sold to the plaintiff. The issue of the patent in the United States was delayed, however, by an unusual situation. There was a Patent Office interference between four different parties, one of whom was a man named Heany, and it was charged that Heany, or his attorney, with the connivance of one of the Patent Office examiners, had fraudulently introduced into the specifications of one of his applications subject matter derived from the Just and Hanamann application.

"An extended investigation was made by the Patent Office and Deputy Commissioner Bullings handed down, on July 7, 1911, a thorough and comprehensive decision holding that the frauds charged were proved. Heany's application was stricken from the files of the Patent Office and his attorney and the examiner were convicted of crime."

TO CONTEST ARBITRARY DEPRECIATION RULING.

Doherty Organization Fosters Movement to Standardize Practice of Commissions.

Due to the seeming unfair stand of most public utility commissions on depreciation when the physical valuation of a utility is made to arrive at an equitable rate, the H. L. Doherty & Company is behind a movement to standardize this item for utility commissions throughout the United States.

V. L. Board, rate engineer, related experience he has had with several commission bodies recently. No set percentage for depreciation is at present in vogue, but the general tendency is for all commissions to reduce the total physical valuation of a property by 20 per cent to cover this item. The unfairness of this arbitrary ruling in many cases is evident when it is considered that when a property starts operation and runs, say, for a period of two years, to keep the service at the highest point of efficiency necessarily entails the replacing of old and inefficient materials with new apparatus, so that instead of the property depreciating in any period it has, in fact, increased in value due to the additions which were necessary to be made. Most utility commissions do not consider this fact, and in their fixing of rates very often have made it a real hardship for a utility to operate and obtain a suitable return

on its investment. Mr. Board was of the opinion that a strenuous stand should be taken by the properties on this item of depreciation in all future hearings before any commissions, and an endeavor made to bring to their attention the true situation of utilities as regards depreciation.

Another point in favor of utilities in this stand, according to Mr. Board, is that in replacing any equipment at this time, consideration should be given to the abnormal costs of such replacing as against a few years ago. This point should be aggressively stated before any commission hearing on a property's physical valuation for the purpose of establishing rates.

AUTOMOBILE HEADLIGHT SITUATION TO BE DISCUSSED.

Illuminating Engineering Society Will Hear Expert Testimony at New York Meeting.

The Illuminating Engineering Society will hold a meeting on the evening of January 10, at 8 p. m. in the Engineering Building, 29 West Thirty-ninth Street, New York City, which will be devoted to the subject of automobile headlights.

A paper is to be presented by W. F. Little, of the Electrical Testing Laboratories, entitled "A Survey of the Automobile Headlight Situation." This paper will present a symposium of the opinions of various men in the lighting and automobile engineering fields, in an attempt to arrive at a consensus as to the requirements. The paper will then describe various headlights upon the market, and in connection with these a demonstration will be made of the lamps which are in general use, together with several types which have not as yet been placed upon the market. This paper will present an absolutely impartial report of progress up to the present time.

Following the presentation of this paper it is planned to hold a symposium of engineers, legislative authorities, police officials, etc., in an attempt to secure a good discussion of the headlight problem from a number of viewpoints.

SPEED CONTROL OF INDUCTION MOTORS.

Cleveland Section Meeting Hears Discussion on Rolling-Mill Drive.—Merger of Cleveland Organizations Proposed.

The American Institute of Electrical Engineers, Cleveland Section, held its monthly meeting on December 18 in the Electrical League Rooms at the Hotel Statler.

There were about 75 in attendance to hear J. D. Wright speak on "Speed Control of Induction Motors for Rolling-Mill Drive." Mr. Wright, who is engineer of the Power and Mining Department of the General Electric Company at Schenectady, illustrated his talk with numerous slides, and a very interesting discussion followed the reading of his paper. It was also decided at this meeting to establish an Advisory Board for the Cleveland Section, composed of the past chairmen. This board is to be headed by the chairman who has been most recently superseded. Another important step taken at the meeting was the appointment of a committee whose duties will be to bring about a more harmonious relation between the Cleveland Section and the other electrical societies of the city, especially the Cleveland Engineering Society and the Electrical League. E. W. P. Smith was appointed chairman of this committee and the other two members are Prof. H. B. Dates of Case School and W. M. Skiff of Nela Park.

The committee feels that there are excellent possibilities in the future of the American Institute, Cleveland Engineering Society and the Electrical League joining forces and obtaining central headquarters, and as these societies grow, there will be greater possibilities of erecting a join club house. Reprepresentatives of the other electrical organizations were in attendance at the preliminary meeting and are heartily in favor of this co-operative activity, inaugurated by the American Institute, Cleveland Section.

DECEMBER MEETING NATIONAL ELECTRIC LIGHT ASSOCIATION EXECUTIVE COMMITTEE.

Busy Session Held in New York at Which It Was Decided to Establish a Technical Bureau of Information.—Place of Annual Meeting Left to President.

A meeting of the Executive Committee of the National Electric Light Association was held in the New York headquarters on December 8. A resolution was passed expressing deepest regret at the death of A. C. Einstein, of St. Louis.

Treasurer Atkins presented the financial report for ten months ending October 31, and a membership report was presented by Secretary Martin.

W. C. L. Eglin presented the report of his committee on Safety Rules and Accident Prevention, and reviewed the preparation of the Safety Code prepared on the initiative and under the supervision of the Bureau of Standards. Mr. Eglin felt that the code just issued by the bureau would eventually, with modifications, be very useful to the National Electric Light Association members. Mr. Eglin also presented a communication from Dr. Rosa, stating that the bureau was very desirous to have close and cordial relations with the association.

E. A. Edkins, chairman of the Commercial Section, presented a report outlining the progress which is being made and tentative plans for the annual convention. There were 420,000 copies of the Commercial Section's Christmas booklet sold.

On the motion of R. J. McClelland, chairman of the Technical Section, the association is authorized to establish a general information bureau, under the direction of a trained executive, for the purpose of accumulating and distributing to the members general information and data regarding engineering problems, and particularly high-tension transmission problems.

E. S. Mansfield, reporting for the Electric Vehicle Section, stated that the Section is planning to raise a special fund of $10,000 or $15,000 from central stations and manufacturers to enable the Section to employ a representative to go out to the central stations of the country, in cities where electric vehicles should be more numerous, and establish electric-vehicle departments, to be followed by the manufacturers with the establishment of branch offices. A good deal of publicity work is also planned in connection with the campaign. Various other reports were presented dealing with other activities of the association.

In regard to the time and place of the next annual convention three localities were given serious consideration, namely, Baltimore, Md.; Pittsburgh, Pa., and Atlantic City, N. J. It was finally agreed to leave the selection of the time and place to the president.

COMMISSION DISAPPROVES CONTRACTS BETWEEN INTERRELATED COMPANIES.

Important Order Affecting Utility Companies in Massachusetts Handed Down by Commission.

An order of far-reaching importance to certain lighting interests has been issued by the Massachusetts Gas and Electric Light Commission. The Commission during the past few months, in connection with public hearings on stock issues or the approval of contracts between related corporations, has expressed its strong disapproval of the practice of a number of lighting companies in engaging with allied corporations having the same officers and directors, wholly or in part, for engineering, management or construction expenses, and the recent formal action is the result.

The order is as follows:

"The board for some time has viewed with concern the control of the directorates of certain of the companies under

its supervision by officials and employees of engineering, construction and management organizations and corporations with which the companies involved have from time to time contracted for extensions and improvements of and managerial services for their respective properties. In the opinion of the Board, such practices are wrong in principle. Whatever justification may exist for them in public service companies whose credit is feeble or future hazardous and uncertain, that justification ceases when their financial position is firmly established. The management of such companies should then be in the hands of directors and officers responsible solely to their stockholders and the public whom they have undertaken to serve. For reasons that are obvious companies should not have any dealings in supplies or materials or make any contracts for construction or management with another corporation, partnership or association when said company has upon its board of directors or as its president, manager, purchasing or selling officer, or as its agent in the particular transaction, a person who is at the same time a director, purchasing or selling officer, or agent of, or who has any substantial interest in, such other corporation, partnership or association, unless and except such purchases shall be made from, or such dealing shall be with, the bidder whose bid is the most favorable to such company, to be ascertained by honestly-conducted competitive bidding. Notice is hereby given of the conclusions reached by the Board to the end that no company under its supervision shall hereafter enter into contracts and relationships of the character above described, save under exceptional circumstances and with the approval of the Board, and that upon the expiration of existing contracts they shall not be renewed."

H. L. DOHERTY ADDRESSES KANSAS CITY CLUB.

Suggests Electric Week by Various Communities and Comments on Big Business.

H. L. Doherty, Jupiter of the Jovian Order, was the unexpected guest of honor and the chief speaker at the banquet of the Jovian League of Kansas City, Mo., at the Muehlbach Hotel, the evening of December 21. Mr. Doherty spoke earnestly on Jovianism, and the great opportunities of the order in the constructive expansion of the industry. He mentioned some of his "dreams" for the order. One of these took hold of the Jovians present; and they are eager to see it brought to fruition. This was a plan for holding special electrical weeks in various cities during the year, without reference to any other cities, and handled locally by the local league. This week would be intended to disclose in each town the ideas for the further uses of electricity in saving labor. Each Jovian would be expected to submit an idea for another use of current.

Mr. Doherty spoke also of the strange situation with reference to corporations at present, under which the attacks and the repression of corporation activity are costing the laboring man and the middle classes comparatively large sums, while the wealthier classes gain no adequate benefit. He mentioned specifically the matter of railroad rates—the lowering of rates saved the average family maybe a dollar a year—but because of the vast total reduction in railroad revenues had so hampered them that they could not add equipment or build, and so the result of sharply higher prices than necessory for commodities bought by the laboring man had come.

John H. Lucas, president of the Kansas City Light & Power Company, was the stated speaker of the evening. He addressed himself to the young men, pointing to the big rewards of diligence and squareness, emphasizing the necessity of service to the public, to others, in any profession or business, for the best and most lasting success.

EXTENSIVE WORK OF UNDERWRITERS' LABORATORIES DURING 1916.

Review of Year's Activities Indicate Broadening of Work, Especially in Electrical Departments.

The steadily increasing demands upon the facilities of the Underwriters' Laboratories for service during the year, in the endeavor to lessen the fire loss and reduce the accident hazard, evidence the growing appreciation of this organization's work. The following brief outline indicates the trend of the work carried on by the laboratories during 1916 and mention is here made of some of the more important developments.

Several standards covering the construction and performance in tests of devices have been issued during the year.

In meeting the multiplying requests for service the laboratories in co-operation with the industry has evolved a new plan whereby the name of the laboratories and the word "inspected," or some suitable abbreviation, is to be directly applied on the article as a part of the manufacturing process.

The services provided are: (a) Inspections at factories with examination and tests of samples of newly assembled material and material in stock. (b) Counter-check tests of samples of labeled goods obtained in the market. (c) Field follow-up tests of samples secured through the co-operation of inspection authorities and users, providing for service value determinations of labeled products. (d) Summaries and schedules of results of tests made, and comparative demerits awarded individual manufacturers employing the label service and industries as a whole.

The laboratories' service of inspections at factories, whereby goods found to be standard bear an inspection manifest or label, has been held back from many lines because of the expense of applying a label of the usual type. Package labeling, while in effect for a number of appliances, has not, by practical trial, been proved to be the correct solution. Advantages secured through the new labeling plan are: the savings effected in cost of labels, and the inspection symbol will be permanent, thus no claim can be made that sub-standard appliances were actually labeled at any time and that the label has been lost.

Inspection service at factories and labeling under both the old and new plans is now in operation in some 1,200 manufacturing plants.

The work of the electrical department is conducted partly at the principal office and testing station in Chicago and partly at the testing station maintained in connection with the New York office. The New York station is provided with all the test equipment, instruments and apparatus for electrical tests as employed at Chicago, and the work is now about equally divided between the two stations. Mention should be made of check tests at two factories by the New York station on very large orders of fire-alarm cable to be used in rehabilitating the New York fire-alarm system. These tests are being made at the request of the New York Board of Fire Underwriters and supplement the city test.

During the year the laboratories have co-operated actively with the manufacturers of electrical fittings and supplies by the establishment of industry conferences, composed of appointed representatives of the manufacturers and the engineers of the electrical department of the laboratories and these conferences have, in turn, reported to the various sections of the Associated Manufacturers of Electrical Supplies, for the purpose of formulating and recognizing standards of design and construction affecting electrical materials and appliances. Such standards as well as several covering other devices, not electrical, have been issued during the year.

Materials for the construction of machinery guards have come before the laboratories in the form of both expanded and perforated metals, tests being made to bring out their values in the construction of guards. Of valued interest is the testing of safety flanges for grinding wheels, which tests are now under way, and in which endeavor is made to measure the holding power of flanges such as are used with tapered wheels to determine the probability of the escape of segments of a wheel which might be accidentally broken during operation. These tests should be productive of valuable results and are of special interest to makers of grinding machinery.

The label service and other methods of supervision are being extended to the new industries as well as being continued and broadened in previously established lines. Standard test methods are being employed, test apparatus is being improved, and this department expects a busy year in 1917.

Besides work in the chemical department on fire hose and hose couplings, chemical extinguisher and gasoline hose, insulated wire and cable, rigid conduit, matches, stationary foam extinguishers, oil-tank vents, hazardous liquids, and various proprietary articles, investigations in the field as to the hazard of plants manufacturing phenol, dyes and cotton-seed products were conducted, and an investigation of the conditions having to do with the safe storage of oxygen under pressure was begun; research work on braids of insulated wire was carried on as a basis for forming a specification; specifications for rubber disks used on alarm and dry pipe valves were formulated; work in determining the characteristics of several bronzes and copper alloys was begun; and research work to obtain a suitable accelerated life test for rubber used in the manufacture of insulated wire is in progress.

Friends of Underwriters' Laboratories have felt that advantage should be taken of all proper means available for keeping insurance people, and the public as well, informed concerning the work of the institution. In line with this, the practice of providing motion-pictures of parts of the work was undertaken a little over a year ago. These have been furnished to insurance organizations, state and municipal officials, credit men, churches, schools, chambers of commerce, city clubs, rotary clubs and various other classes of organizations and interests for projection at meetings and conventions in cities and towns in more than half of the states and in Canada. Whenever the usual routine of the laboratories' activities has made it convenient to do so a lecturer has been provided along with the pictures. This has been the case perhaps two-thirds of the times when the films have been shown. These pictures are being revised and greatly extended at this time, with the addition of comprehensive explanatory titles, and here and there, of scenes of a popular, human interest sort. They will continue to be available for projection where they can be effectively used.

Cambridge Company's Career Reviewed in Industrial Supplement.

Writing in a pictorial supplement of the Cambridge (Mass.) *Chronicle* of December 9, Walter R. Eaton, electrical engineer of the Cambridge Electric Light Company, reviews the history of the corporation, going back to the early days, when the equipment consisted of a twin Buckeye high-pressure 250-horsepower engine, two 100-horsepower boilers and 10 Weston dynamos of 20 kilowatts capacity each.

The company was incorporated in 1886. On October 15 of that year street lights were turned on. The second station was completed in the fall of 1888, and contain Thomson-Houston arc-light dynamos, besides two alternators. In July, 1889, the first successful electric car line was operated in Greater Boston, the company furnishing the current.

The company's present output is 70,000 kilowatts. It has about 115 miles of underground ducts and about 80 miles of cables.

Examination Dates for Electricians' Licenses in Massachusetts.

The State Examiners of Electricians of Massachusetts have set the following dates and places for the examination of candidates for masters' and journeymen's licenses:

Boston—January 3, March 8, May 2, June 28, September 5, and November 7.

Fall River—February 7, July 11.

Pittsfield—January 17, June 6.

Springfield—March 28, September 19.

Lowell—April 4, October 10.

Worcester—May 23, October 24.

Applicants for Class B, or journeymen's certificates, must be at least 18 years of age. Examinations will test the applicant's knowledge of the National Electrical Code and practical electrical work. Applicants must receive 70 per cent to qualify.

Chicago's Municipal Christmas Tree Flood-Lighted.

A spectacular lighting effect was achieved in the lighting of the Chicago Municipal Christmas tree, which was installed at the lake front in Grant Park and dedicated to the public, with appropriate ceremonies on Christmas eve.

The general plant of illumination followed that adopted last year, when flood lighting was used for the first time for this purpose. Projectors are installed on the balconies

Chicago's Municipal Christmas Tree.

of buildings on Michigan Avenue, several hundred feet distant, and the light from these is supplemented by light from units installed at the base of the tree.

Electrical Exports for October Again Set New Monthly Record.

Another new monthly record has been established in electrical exports from the United States in the figures just made public for October. The official summary of the foreign commerce for that month issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., shows an electrical-export total of over $4,000,000, or nearly 12.5 per cent greater than for the record total set last August. The October total is over 85 per cent greater than that of the corresponding month in 1915.

The numbers of articles shipped are given in the government reports for only four electrical classes, which last October were as follows: Electric fans, 930; arc lamps, 45; carbon-filament lamps, 229,529; metal-filament lamps, 667,424.

The following table gives the detailed electrical-export figures for last October and for October of a year ago:

Articles.	October, 1916.	October, 1915.
Batteries	$ 173,734	$ 82,554
Dynamos or generators	249,281	137,445
Fans	13,949	34,578
Insualted wires and cables	575,024	201,856
Interior wiring supplies, etc. (including fixtures)	89,214	63,307
Lamps—		
Arc	644	1,234
Carbon-filament	27,164	17,223
Metal-filament	98,908	106,428
Meters and other measuring instruments	80,895	56,272
Motors	526,231	290,623
Telegraph instruments (including wireless apparatus)	18,366	30,171
Telephones	105,146	72,493
Transformers	90,367	64,908
All other	1,996,722	1,020,361
Total	$4,045,645	$2,179,453

Not listed in the foregoing are electric locomotives. During October six of these, valued at $129,768, were exported.

A summary of the electrical-export totals for the first ten months of each of the last three years, ending with October 31 in each case, gives the following stirking comparison: 1914, $16,697,829; 1915, $19,419,403; 1916, $31,073,268. The separately listed figures for electric locomotives for the corresponding periods are as follows: 1914, $578,338; 1915, $199,270; 1916, $517,858.

New High-Tension Insulators Described and Tested at Minnesota Meeting, A. I. E. E.

A joint meeting of the Minnesota Section and the University of Minnesota Student Branch of the American Institute of Electrical Engineers was held December 18, at the University of Minnesota, at which Lincoln Nissley, of the Northern States Power Company, read a paper on "Transmission Economics and the Insulator Problem."

He described the new high-tension insulators which are proving to be so much of a success on several of the Bylles-by lines in Minnesota and elsewhere. A 110,000-volt insulator weighs only 36 pounds, as compared to 90 pounds for the average porcelain insulator for the same voltage. The cost is only a fraction of that of the regular porcelain insulators. The characteristics of the insulator are such that it arcs from top to bottom without damaging any of the glass disks, whereas the ordinary string of porcelain insulators arcs from unit to unit, frequently breaking the porcelain.

After the reading of the paper by Mr. Nissels the students of the electrical engineering department exhibited tests of a number of units of the B-5 type for 60,000 volts and of the B-11 type for 110,000 volts. These tests were conducted in a darkened room, which enhanced the spectacular effect. The B-11 type was arced over a number of times at about 310,000 volts, 60 cycles, obtained from the special Thordarson 300,000-volt transformer recently installed in the electrical laboratory. The insulator was also arced over by current from a Tesla coil at about 125,000 cycles, without any apparent injury to the insulator. The corona about the insulator and the wires was a most interesting and beautiful display in the darkened laboratory. The students also performed a number of experiments, showing corona and discharges between sphere gaps six feet apart.

Special Tesla Coil for Tests.

The special Tesla coil used was built by students in the electrical laboratory at the University of Minnesota, and is designed to give about six million volts at 125,000 cycles. The primary has eight turns, is 28 inches in diameter and 21 inches long. The secondary is 20 inches in diameter, is six feet long and has 764 turns of No. 19 enameled wire. The coil is designed for an impressed voltage of 60,000, and the insulation is a combination of paraffin and paper. The coils are mounted in a large wooden base, the total weight of the coil being about 600 pounds. A special oil-immersed condenser that will withstand nearly 50,000 volts without breaking down, was designed and built for this coil. This represents a new departure in high-tension condensers for this purpose, and is much cheaper and more compact than the usual type of glass condenser.

Seattle Wireless Company Wins Legal Victory.

The Kilbourne & Clark Manufacturing Company won a suit brought in the federal district court at Seattle, Wash., against it by the Marconi Wireless Company of America, for alleged infringements of patents claimed by the latter company.

The decision establishes that none of the commercial apparatus manufactured by the Kilbourne & Clark Manufacturing Company infringes the patents of the Marconi company. Suit of the Marconi company was brought more than a year ago, alleging infringement of the Lodge patent, of which it claimed ownership, and also of a certain Marconi patent, both involving radio apparatus. Plaintiff alleged damages of $1,000,000 and asked that the defendant company be enjoined temporarily from making any of the radio equipment.

The decision covered 50 typewritten pages and held that the three types of radio apparatus, known as the Simpson transmitter, Thompson transmitter and the Standard receiver manufactured by the Kilbourne & Clark Manufacturing Company, were non-infringing.

The whole wireless situation was thoroughly covered, and no detail was left in obscurity. The government of the United States was interested in the investigation and several of its radio engineers appeared as witnesses for the defense. A deposition from Inventor Marconi, given after three months' investigation in the European war zone, was a feature of the trial.

In his decision Judge Neterer held that the mere fact that the same result is obtained by operation of an apparatus is not conclusive of infringement. He held that the apparatus complained of is fundamentally different from the Marconi apparatus.

Kansas Telephone Association Elects Officers.

The Kansas Independent Telephone Association, at its annual meeting in Topeka last week, adopted resolutions against further extension of Federal control over public utilities and common carriers. The following officers were elected:

President, T. L. Youmans, Osawatomie.

Vice-president, J. D. Waters, Bonner Springs.

Secretary, J. H. Close, Topeka.

Treasurer, W. P. Hemphill, Ottawa.

Directors: T. L. Youmans, J. D. Waters, W. P. Hemphill, A. J. Stevens, Hiawatha; G. M. Stratton, Clay Center; C. A. Sloan, Pratt; J. R. Shipley, Fredonia; J. W. Berry, Jewell City; C. J. Myers, Kansas City.

The Value of Trial Motor Installations

Expressions from the Leading Central-Station Power Engineers of the Country Pointing Out the Importance of Trial Installations in Securing Power Business

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for September 9, 1916, we published an interview with the power engineer of a prominent Middle Western utility company, dealing with the importance of making trial motor installations to secure the business of skeptical customers.

Considerable interest was manifested in this article, the trend of opinion being largely in favor of making trial installations. In the few instances where this policy is not advocated, it is because business conditions are so good that it has not been found necessary to offer any special inducements to secure power business. A typical case is that of the Public Service Company of Northern Illinois. J. G. Learned, assistant to the vice-president, in charge of the contract department, has the following to say in regard to trial-motor installations:

"No doubt local conditions may have some bearing on making trial motor installations, and while it might not be good policy in some communities, on the other hand, it might be productive of considerable business to make trial motor installations.

"Our business has developed to such an extent that we do not feel the necessity of putting motors out on trial. We are always willing to meet a customer half way by offering to rent motors for a trial period. Where we have made such contracts on a rental basis we have always been successful in retaining the business, except in such cases where we knew in advance that it was for temporary service.

"I think that central-station companies can be very liberal in selling motors and wiring on installments to growing concerns, especially those where they are replacing an isolated plant with central-station power.

"It is also very important for central stations to act as the agent for the owner of an isolated plant in disposing of his generating equipment, and in many cases it is desirable for central stations to purchase the isolated plant outright."

As a general rule, trial motor installations are advocated for all prospective customers where there is doubt as to the operating costs or results, and to influence otherwise skeptical customers. There are, however, numerous policies in effect regarding details, such as the form of agreement to use, payment of installation costs, etc.

The following statement from Leon H. Scherck, sales manager of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., is typical of general practice: "A central station should be willing to make trial installations, provided this is necessary to convince a prospect that its engineers' estimates will work out in practice. I think when trial is made of a large installation there should be an agreement that in the event the estimated results are accomplished, the installation will not be thrown back on the hands of the electric company. In other words, trial intallations offer excellent means of proving to a prospect what you actually know from your experience will take place. There is, however, no need of having such a loose agreement with the customer that he feels at liberty to throw out an expensive installation in the event practical results are as estimated. We have been liberal in offering trial installations, and, provided these are not expensive, we would even go so far as to waive any condition of contract at the end of a trial period, leaving that question open until the demonstration is over. My first statements refer primarily to such trial installations as involve considerable expense." Policies of a number of other important companies are given in the following paragraphs. Much interesting data on the subject are brought out.

While practically all companies solicited favored some plan of installing motors on trial, there is brought out in the following symposium a number of different plans. Some companies believe in offering every skeptical customer a trial installation while others hold that this practice only pays where the installation is of decided importance. Most companies agree that the customer should pay a rental on the equipment during the trial period.

TRIAL INSTALLATION LANDS ORDER

By Charles B. Yonts, General Contract Agent, Illinois Northern Utilities Company, Dixon, Ill.

In a town of 500 inhabitants there is a farmers' elevator company with 160 stockholders, which serves a large territory in grist milling and elevator business. For three years we have tried to replace the gasoline engine with an electric motor, but were not successful, the manager of the company being very much in favor of oil-engine operation. He knew what the cost of operation was and also a great deal about the engine, having never operated anything else in his 15 or 20 years' experience in that business. The stockholders were using engines on their farms and naturally favored them.

Things went along until last winter when the gasoline engine began to show signs of wear and they had a lot of trouble in starting it in zero weather, and the price of gasoline started to soar. Our local representative notified us that at a meeting of the board of directors, they decided to buy an oil engine. We immediately got on the job and although every proposition we offered was not refused, they did not accept any and continued with their plans for buying a crude-oil engine.

There were several engine men on the job, competition was very strong, and they all claimed lower operating costs than an electric motor.

We have a rate of 3.5 cents net for grist mills. Up to that time they had done very little grist milling. We found they had an old Bowser mill in the elevator and told them it could be operated with a 15-horsepower motor. They were than using a 15-horsepower engine in the elevator and mill, but could not operate both at the same time.

Finally we got the manager and stockholders together at a meeting, presented our written proposal: that if they would put in a grist mill we would give them a rate of 3.5 cents net per kilowatt-hour in return for their staying off the peak; not operating between the hours of 4 and 8 p. m., and felt reasonably sure that this proposition would be accepted.

The meeting was on Saturday and as it was held to consider the proposed electric-motor drive, we were requested to stay, which we did, but found that the oil-engine men were on the job and had practically closed with them.

On the face of the figures, the income did not amount to more than $300 per year on the business they had been doing and we hardly thought it worth while to make a trial offer, as the cost of running the service was so great the income from first glance would not warrant the investment. After the meeting, that Saturday, when the

oil-engine men double crossed us, our pride led us to have a representative take the first train out Monday morning to see them again. He discovered two oil-engine men on the train. Needless to say, our representative got off the front end of the coach and got in the elevator before the oil-engine men finished their game of "rummy." Finding the manager had not arrived yet (it was before 8 o'clock), he walked up to the postoffice and found the manager of the elevator there, and made the proposal to put the motor in on trial. Their claim had been that we were having interruptions to service and that they could not operate off-peak. In our proposal we had told them the trial would include service as well as the cost of operation, they to be the judges.

We offered to spend $300 which did not include the motor, to give them immediate service and which they could not get with their oil engines. We made this installation, not so much from a standpoint of earnings, but to demonstrate to these 160 farmers the desirability of electric drive.

It seems that the matter had been left in the hands of a committee of three. We saw to it that the manager stayed at the postoffice until he had telephoned the other members of the committee. We then got into an automobile and went out to see them and got their permission to make the trial installation before the elevator man got back to the elevator. The oil-engine men were at the elevator when we got there and the manager laughingly told them to come in within 60 days. We had not only put a 10-horsepower motor on the Bowser mill, direct-connected to a flexible coupling, but a 15-horsepower motor in the elevator proper. With this mill outfit they ground 3,000 pounds of corn and oats in one hour, for 35 cents, and got 10 cents per hundred for grinding.

The manager told the writer after the first two weeks, that the farmers assured him that if he would put in a mill with sufficient capacity to do their grinding for hog food as well as cattle, they would give him all of their business.

The point of the story is that he has entered his order for one of the big mills which will have a 40-horsepower motor connected which will enable him to turn out a ton of grist every 20 minutes for the same price as the farmers could get in larger towns and he is very well pleased with the cost of operation.

Although we expected only $300 per year, we will get at least twice that much. I feel sure that we would not have secured this business without a trial installation.

Our engineer makes the statement: "I don't know of anything more convincing than this installation, inasmuch as it made 160 farmers 'think alike.'"

PROMOTES CONFIDENCE IN COMPANY

By D. M. DeBard, Power Sales Department, Edison Electric Illuminating Company of Brockton, Mass.

I am a great believer in trial motor installations. It is a big business getter and might rightly be termed "the big gun" of the power-sales department, as all the good points of electric drive can be demonstrated to the satisfaction of the customer. It establishes confidence and makes the customer feel that the electric company is willing to share the risk with him.

The trial proposition offered by the company that I am with is as follows:

The company agrees for a period of one year to install, at its own expense, all motors which it believes will efficiently drive the machinery of the customer, and in addition thereto the company agrees to install wiring necessary to apply the above mentioned motors to the shafts and machines of the customer, the shaft pulleys and belts to be furnished by the customer. The customer agrees to pay 15 per cent per annum, in equal monthly installments, on the total cost of the electric installation to the company. At the end of the trial period the customer is made the judge and if the installation proves satisfactory, the customer agrees to accept it, at its cost to the company, less a credit of 60 per cent of the amount that he has paid as rental. If the installation is not satisfactory, the company retains the 15 per cent paid as rental, and agrees to remove its apparatus within 60 days. The energy used is billed on the company's standard rate, the same as if the customer owned the installation.

The confidence placed in the customer in making him the judge as to whether the installation is satisfactory or not is greatly appreciated by him and a fair deal is usually the result. Since 1916 we have secured five plants, a total of 650 horsepower, by this method.

TRIAL ONLY FOR LARGE CUSTOMERS

By C. A. Collier, Assistant to Sales Manager, Georgia Railway & Power Company, Atlanta, Ga.

We have always followed three well-defined plans in attempting to interest a prospective customer in what we might term a "trial installation," the words "trial installation" as distinct from the electrification of his entire mill or plant. These three plans are as follows:

First: We attempt to have the customer purchase one motor outright and install this one motor on some particular section of his mill, and there endeavor to keep the cost of production on this particular section separate from the mill as a whole.

Second: Failing to interest the customer in Plan No. 1, we offer in some instances to sell a motor or motors on a deferred-payment plan, at cost.

Third: We have, in quite a number of instances, where neither of the above plans brought success, loaned to the customer for experimental purposes one or more motors for installation in his mill during a period of months.

The success of the above plans we have found to be about as follows:

Plan No. 1 works equally as well as Plan No. 3 if the customer is a large one and is willing to spend a moderate sum of money for the purpose of determining accurately and conclusively the advantage of electric drive, and we have found that on cotton mills particularly, this plan appeals more than either of the remaining two.

Under Plan No. 2, we have obtained some business through the installation of trial motors sold on installment plan, but as a general rule, we find that the customer who wishes to purchase his motors on the installment plan for trial purposes only, is not as a general rule very actively interested in the proposition, and holds back on a final decision on account of the failure on his part to keep accurate cost and production records.

Under Plan No. 3, we have succeeded admirably in obtaining several very attractive power contracts. In one instance, the loan of three motors aggregating 150 horsepower to a large railway shop during the period that their main engine was out of commission resulted in our obtaining business aggregating 175 horsepower at said shops. In this instance, the customer paid for all necessary wiring for the motors and for all cost of handling said motors.

The loan of a 50-horsepower motor to a knitting mill secured for us recently the larger portion of the mill, aggregating 210 horsepower, and it is only a question of

a few months until we secure the entire mill, aggregating 500 horsepower.

In a third instance, the loan of two 50-horsepower motors to a cotton-seed oil mill for the purpose of driving an attrition mill and cake breaker secured the business of the entire mill aggregating 150 horsepower, while in still another instance the loan of a 100-horsepower motor secured the business of a second oil mill, the business aggregating 600 horsepower.

It has not been, and we hardly believe it will be, a custom of this company to lend or put out motors in small industrial establishments on trial, as we have found that we can obtain this business without the trouble and expense coincident with a motor loan. However, it might be of interest to mention that the rental of motors at so much per horsepower per month to building trades in this city has almost eliminated the steam hoist and concrete mixer in building operations. We have had at one time as much as 200 horsepower in temporary construction service under this arrangement, the current being paid for in addition to the rental charge for motors at the rate of six cents net per kilowatt-hour. This business was worked up and the prospect shown the value and economy of electric power for this type of business, even at the rate above mentioned, solely through the willingness on the part of this company to put in a stock a number of motors for this type of service.

In view of the results obtained, we therefore believe that the installation of motors for trial purposes should be made only in the cases of large mills whose business the central station should have, because of the saving to be effected by central-station service, in large industrial establishments, or in the case of temporary construction work where it is practically impossible to get the contractors to discard the steam hoist and mixing equipment to purchase motors outright.

NO EXPENSE TO CUSTOMER

By C. H. Myers, New-Business Manager, Tri-City Railway & Light Companies, Davenport, Ia.

With reference to trial motor installations, we have practiced in Davenport this method of interesting "would-be" consumers in electrical power. When an installation of this kind is made we usually furnish the motor, as we carry at all times in stock a variety of sizes and speeds of motors. When we have a prospect who is somewhat doubtful as to what electric power will do and, after exhausting all our talking points and he is still skeptical as to the results, we often make this proposition:

That we will install for him the proper motor or motors to operate his factory or mill, whichever it might be, the same being installed along lines of best engineering practices. This trial installation is made for either a 30, 60 or 90-day period. We carry the expense during that time of the installation and, if at the end of that period the consumer is not satisfied with the results obtained, we will remove the equipment and charge him only for the time that has been spent in connecting and removing, crediting him for the good material that is removed. However, during the installation the customer pays for the current consumed each month at our regular power rates.

The writer has one particular installation in mind where a 30-horsepower motor was installed to operate a feed mill. We had talked the situation over thoroughly several times with our customer and were not able to make the sale of the motor and the installation direct, but we had to prove to him that the assertions which we made were correct. In so doing we chose the above described manner of procedure, the result being that at the end of 30 days the cost of operating was such that the consumer thought that he would like to try it another month. At the end of the second month another month's trial was asked for and at the end of the third month the consumer was entirely satisfied that electric power was the only method for him to use in operating his mill.

He consequently gave the power salesman the order for the motor and the necessary wiring which had already been installed. This installation has been in operation now for some three years and we venture to say that we do not have a better satisfied power consumer on our lines than this one.

OVER 1000 HORSEPOWER SECURED

By F. B. Steele, Power Engineer, Dayton Power & Light Company, Dayton, O.

It has been the policy of our company, for several years, to carry a comparatively large stock of motors for emergency break-down service. In case a customer has a burnout in one of his motors, we immediately agree to loan him a motor from our stock for a period of 30 days absolutely without cost to him. During this time, we expect that he will be in position to replace the burned-out motor or have same properly repaired.

It developed that customers frequently asked for the use of a motor to try it out and if satisfactory would agree to either buy the motor or purchase one elsewhere. The necessity of a try-out proposition became so apparent that we are now installing motors on trial in wholesale quantities, and in some cases install the motors absolutely complete including wiring and millwright work free of cost to the customer in order to demonstrate to him we have faith and confidence in our proposition. Our stock of motors range from three horsepower to 75 horsepower and we are prepared to place any factory requiring 150 to 200 horsepower in operation on short notice.

Some manufacturers are very skeptical as to the advisability even of making a try-out on motors and will not obligate themselves to that extent. We, therefore, make a careful survey of the factory, making complete records showing the speed of line shafts and approximately the horsepower necessary to drive same so that in case of accident to the prime mover we can rush in on short notice and install motors of the proper size and speed to do the work. During the past 18 months, we have installed motors on the trial basis and have closed something like 1,000 horsepower by this method.

On December 23, 1915, a power prospect, who required approximately 200 horsepower and whose factory had been surveyed by our company, called up and said the main line-shaft drive from his engine had sheared off and wanted to know if we could arrange to give him assistance. The repair to the shaft would require approximately four days to a week. We guaranteed to have the factory running in less than 48 hours, provided we would be permitted to keep the motors in long enough to make a complete test. This was readily agreed upon and sufficient electric power was installed in 28 hours and the factory was ready to operate. Thirty days after this installation was made, contracts were closed for a complete electrification.

Another case, which was of particular interest, happened immediately after a flood which placed a prospect's engine out of service. He required about 12 or 15 motors and agreed if we would loan him sufficient motors to operate his plant, he would purchase new ones and sign

a contract for his power. This we did, very gladly, and this prospect is now very well satisfied.

We intend to carry, say four 50-horsepower motors, as a portion of our stock for purely emergency break-down service and, in almost any case, we can have a broken-down factory operating in 24 hours. "Service" is the most important item in connection with our business and the more we realize the fact the better pleased our customers will be and more business will be secured.

Should we decide not to make trial installations, it would be very difficult to secure some business and some prospects would not become customers for several years.

ONE INSTALLATION COST $7500

By C. H. Stevens, Manager, Power Engineering Bureau, Edison Electric Illuminating Company of Brooklyn

The Brooklyn Edison Company has gone as far on trial motor installations as to install the complete electrical equipment in an artificial-ice plant at a cost of approximately $7,500 on a two years' trial basis. In this instance the owners had been operating steam engines in their plant and knew, therefore, what their cost of operation by this method would be. They were interested in the figures which we submitted them for operating electrically, but as there was no guarantee attached to our contract, they did not see their way clear to make the initial investment for electrical apparatus on what they considered was perhaps a gamble. We were sure of our figures and therefore made them a proposition to install the entire equipment on trial. They are now operating exclusively on our service with entire satisfaction and are paying us approximately $20,000 a year and expect to double the capacity of their plant this year.

This is an exceptional instance. However, we stand ready to meet any prospect more than half way on any reasonable trial proposition, after first assuring ourselves that he is in good faith and that our figures on operating are conservative. In such cases the owners do the wiring and installing and we usually ask a small rental for the motors during the trial period, any amounts paid as rental to apply to the purchase price of the apparatus if they decide to purchase within the trial period.

As a general proposition, it would seem that if any central-station company is assured of the figures which they submit and if the prospect states that he would be willing to install service if he were satisfied the figures were correct, but does not care to make the initial investment on a chance, there should be some way for both parties to get together on some fair and equitable trial basis, and if the rates are reasonable and the apparatus properly installed the cases will be very few and far apart where the apparatus does not remain permanently.

CONSIDERABLE BUSINESS RESULTS

By H. O. Stewart, Engineer, Industrial Department, Rochester (N. Y.) Railway & Light Company

We have been making trial motor installations for a number of years and have found that they are the direct means of obtaining a considerable amount of power load which probably could not be obtained otherwise.

The opportunity to make a trial installation results from: (1) Break-down in existing source of power; (2) load in excess of what the source of power will carry; (3) power unreliable; (4) high cost of power; (5) probable increase in factory production.

In order to make a trial motor installation in a factory where there is a break-down in the power plant, it is essential that the central station has on hand, or has immediate access to, a stock of motors of sufficient size to drive several good-sized factories. Care should be taken to select motors of such horsepower and speed that they can be quickly belted to the average line shaft. The central station should also have on hand, or access to, the services of several electricians who can make a motor installation with the greatest possible speed consistent with first-class workmanship.

The other reasons for making a trial installation do not require so much speed in installation work, but nevertheless it helps, and a stock of motors, together with the means of making an installation quickly and in first-class shape, are most desirable.

It is essential that when a trial installation is to be made, the prospect should be shown definitely what the cost of operation will be. Failure to do this is liable to result in the installation not being accepted.

High-grade engineering judgment is essential on all trial-motor installations, no matter how simple. Poor engineering is responsible for most failures. Excessive pulley ratios, tight and inadequate belts, pulleys working loose on shafts, clumsy control, too small fuses, motors not adapted to the work they are being used on; these troubles counteract most of the good to be derived from trial installations.

In general, the best way to make a trial motor installation would be as follows: (1) Make a motor lay-out and estimate of the cost of motors and installation.

(2) Determine what the power is now costing (if machines are already in use).

(3) Determine the approximate cost of operating the proposed trial installation.

(4) Give the prospect a copy of the above data for his approval.

(5) Make the installation.

(6) Watch the operation of the installation very critically for the first few days, and promptly make all adjustments and changes necessary to give entire satisfaction.

It has been found that when this method has been followed, the trial motor installation is most successful.

TRIAL MOTORS AS A LAST RESORT

By H. D. Stokes, Power Engineer, Worcester Electric Light Company, Worcester, Mass.

We, in Worcester, are going after the power business. Our object is to obtain all of it if possible. This necesitates that we use every way that is legitimate to obtain the hard contracts. Therefore, we believe in trial installations.

We make offers to prospects for trial installations only when other methods fail. Sometimes we are sorry that we have not made the proposal sooner, as we have had very good success in most cases. We require that the prospect stands the cost of installing the motor and wiring same, while we furnish the motor free of charge for his use during the time of trial. We always keep a large stock of motors, and on a trial proposition use new motors if we have them in stock.

In citing a case where we have made a trial installation, we might mention a belting concern, with whom our salesman had negotiated for a year or more. The salesman had been allowed to test the engine, go into details

in the factory, make a layout, estimated the cost in a complete report, but still the prospect would not make a move to take our service. He accepted our trial offer, and we feel certain that we will turn this into a permanent customer.

Another case is that of a clothing manufacturer who desired to run part of his machinery through the night. He was planning to use his engine, as he did not believe in central-station power. We made him a proposition to supply a motor for six months free of charge, and to pay for the current estimated at our regular rates. Another case is a die-sinking concern who would not use our power as they said that they did not believe that our figures on the cost of electrical operation were accurate, and in their estimation they were lower than the cost would be. We installed a 35-horsepower motor. In this case we even paid for the cost of installation. At the end of three months, they were more than satisfied, and paid us for the cost of wiring as well as purchasing the motor.

A woolen manufacturer who had both water and steam power available decided that he would put in a wet-finishing department. He had sufficient steam power available, but our trial proposition interested him to the extent that he installed a 40-horsepower motor, which we furnished free for one year. At the end of the trial, he purchased the motor and now asks us to make him a proposition for the entire mill.

A wall-paper concern is now availing itself of our trial offer to the extent of 120 horsepower and five motors. This concern has always been interested in electric drives, but would not sign a contract as they said that they were certain in their case that it was to their advantage to use steam engines for power. The cost of operation is about as we estimated, but the other advantages of purchasing power are the items that are to make them our permanent customers.

We also had the case of a wire goods concern where our trial proposition met with failure. At the end of the trial term, which unfortunately was in the winter, this concern purchased a generator which they put on their engine and bought the motors from us, so they had a motor-driven plant with alternating-current motors. The cost of operation during the trial of electricity was greater than the cost of operation under steam power. During this trial, the employees of the mill stated that they had the best heat that they had ever had, which was owing to live steam with greater pressure. We feel that we will still obtain this business at a later date.

One of the other methods we use to obtain complete power business in factories is to lease motors, the customer paying five per cent on the investment, and paying for the motors monthly. We have obtained several good contracts in this way.

Central-Station Service More Economical Than Oil Engines for Flour Mill.

Keen competition was made by the St. Joseph (Mo.) Railway, Light & Power Company in the closing of a power contract with the Larabee Flour Mills of that city recently. The competition was in the form of Diesel oil engines.

The load when connected will be for 1,000 horsepower with a 90 per cent load-factor, and will mean a yearly revenue estimated at from $35,000 to $40,000 for the Doherty company.

The Larabee Mills are at present building a new plant to bring its output from its present total of 2,500 barrels of flour a day up to 5,000 barrels. This power will be used in the new mill when erected.

The St. Joseph company has another large power prospect in view, and if negotiations are closed will be as large as the Larabee installations.

THE ECONOMY OF ELECTRICITY IN EXCAVATING.

Steam Equipment Superseded at Arizona Mine and Considerable Saving Is Effected.

The Ray-Consolidated Copper Company has for the past year been carrying on extensive developments on their property at Hayden, Ariz., in connection with which it has been using a small electrically-operated dragline excavator, mounted on caterpillars. The dragline operation is interesting as it has replaced the team method in a very satisfactory manner.

The work which has been done is in short, the building, enlarging and cleaning out of an open-cut canal or sump at the pumping plant, the repairing of old dikes, and the building of a new levee or dike across a gap in the Gila River Valley which had previously been washed out by floods.

The dragline excavator which was purchased for the purpose, was a class-7 Bucyrus machine equipped with a one-yard bucket and a 40-foot boom. As stated, it is operated by electricity and mounted on caterpillar traction. The motors are designed for three-phase, 60 cycles, 440 volts, the main hoisting motor being a variable-speed intermittant-duty type of 50 horsepower. The dragline is equipped with a hand-operated cable reel designed for 500 lineal feet of power cable.

The first work that the dragline did was to clean out and enlarge the old open-cut which is mentioned above. This sump is used for storing and collecting water which is pumped up to a reservoir for use in the concentrating mill by a pumping plant. Its first work was to remove an old spoil pile alongside the old open-cut which had been made by a revolving crane equipped with a clam-shell bucket. This was done in preparation for widening this waterway. The sump is about 2000 feet long, about 100 feet wide on the top and 30 feet deep with slopes of about 1 to 1. The material was mostly sand, gravel and tailings which were very soft and made rather treacherous ground to operate on. It was necessary therefore, to stand six feet from the edge of the bank in order to operate in safety. This made the distance from the toe of the slope about 41 feet and it was necessary to dig beyond that. This job, however, was done with little difficulty. At times this machine was working with a total reach of about 118 feet which is a splendid performance for a dragline with a 40-foot boom.

The output of course has varied considerably, but at times it is a safe estimate that the machine was making 1000 yards a day in about seven hours work. Its average operating speed under these conditions was about two buckets a minute. During the month of June the dragline excavator placed 19,745 cubic yards of material in 1250 feet of dike using 6100 kilowatt-hours, which is produced there at a cost of about one cent per kilowatt-hour, making the total power cost only about $61 for the full month. The machine was operating 29 days, an average of about seven hours per day. It is important to note, however, that the yardage given does not include a great deal of material which it has been necessary to cast away and waste, because of the fact that it was too soft to use in the dike. At times the percentage ran up to nearly 50 per cent of the material removed during the day. The yardage is practically double that obtained by the old team method and the cost is considerably lower.

Topeka Considers Abandoning Municipal Street-Lighting Plant.—A suggestion has been made here that the city abandon its electric plant which now supplies current for street lighting only, and buy current from the Topeka Edison Company. The city plant is said to be in need of repairs, and the suggestion made is based partly on the difficulty of securing enough money to put the plant in proper condition. The Topeka Edison Company is charged with a certain amount based on its earnings each year, and the energy for street lighting would pay this amount, so that the company would not pay cash.

Advertising Suggestions for Central Stations

A Discussion of Some of the Essentials in Advertising Electricity, Its Service and Application—From a Paper Presented Before the Southeastern Section, N. E. L. A.

By J. C. McQUISTON

THE thing that justifies the advertising of electricity is that everybody has a desire to use it, or at least to be a beneficiary of its service.

However, the wonderful refinements that parallel its use cause many to feel that it is costly and beyond their means. While from year to year this erroneous impression is being eradicated from the minds of many by advertising, still there is much work to be done before people come to appreciate electricity as a necessity in home life, as much as we now regard it in business.

In the beginning we were attracted to the use of electric current through its qualities for giving light, and today, and probably always, it will be the light-giving feature of electricity that will first carry the service into the unwired homes and the unelectrified industries. The utilization of electric appliances in the home and the introduction of motors and other electrical apparatus in the factory most naturally follow the lighting of the home or the industry.

Therefore, in whatever plans may be made for advertising, and by this means extending the use of electric service anywhere, we must never lose sight of what we may call the leader, which is the electric lamp. We may use as an appeal for the wiring of the home the convenience of the electrical appliance, but no appeal will reach the multitudes and means so much as the appeal for electric lighting, which means the best light, the safest light, the cleanest light, the most convenient light, and altogether the light above all other lights which spells "modern illumination."

Newspaper Best Medium.

In the first place, the central station should be known in its community. It should be known for its service, for the courtesy of its representatives meeting the public, and for all the good qualities of the organization which should not be hidden under a bushel, but should be brought in a dignified way to the attention of the people.

For this purpose the newspaper is naturally the best medium, and public service companies generally recognize the great service of the daily press and give it their support.

It is so easy to assume that everybody knows about us; that they know our location; that they know what we have to sell. If this were true it would still be necessary to do some advertising to acquaint those who move into our communities later as to our location and business.

The newspaper copy should be such as to create good will and confidence. It should be educational in that it should give the customer an insight into what it means to render such service as you do. Now and then the copy might briefly give a hint at what lies behind the electric

"Spring Cleaning"
To really appreciate the value of an electric vacuum cleaner, arrange to own one before you start "Spring Cleaning." All the "hard work" of this important operation will be eliminated by this modern and highly efficient appliance
Moreover, with it you will be able to accomplish far more than several servants using the obsolete broom or carpet sweeper. Visit one of our Show Rooms and ask to have an electric vacuum cleaner demonstration
The New York Edison Company
At Your Service
General Offices: Irving Place and 15th Street
Telephone: Stuyvesant 5600
Branch Office Show Rooms for the Convenience of the Public
424 Broadway Spring 9090
126 Delancey Street Orchard 1960
10 Irving Place Stuyvesant 5600
*124 West 42d Street Bryant 5262
*151 E 86th Street Lenox 7780
*27 E 125th Street Harlem 4020
*362 E 149th Street Melrose 9900
*Open Until Midnight
Night and Emergency Call: Farragut 3000

A Particularly Productive Newspaper Advertisement Used by the New York Edison Company During "House-Cleaning" Season.

Hints for a Hostess
The difficulties of entertaining your guests and preparing food for them at the same time disappear entirely when you employ competent "Electric Servants"
With your electric toaster, chafing dish, grill and percolator on the table before you, you can attend to every detail of cooking, and at the same time take an active part in the conversation. There is no wearying "kitchen work" required in the modern electric household. Call at our Show Rooms and ask for demonstrations of these modern cooking devices
The New York Edison Company
At Your Service
General Offices: Irving Place and 15th Street
Telephone: Stuyvesant 5600
Branch Office Show Rooms for the Convenience of the Public
424 Broadway Spring 9090
126 Delancey Street Orchard 1960
10 Irving Place Stuyvesant 5600
*124 West 42d Street Bryant 5262
*151 E 86th Street Lenox 7780
*27 E 125th Street Harlem 4020
*362 E 149th Street Melrose 9900
*Open Until Midnight
Night and Emergency Call: Farragut 3000

One of a Series of Commendable Advertisements Used by the New York Edison Company During the Winter Social Season.

button—the men that stand guard all night that light may be had at any time—the men who are on duty when snow and sleet weighs down the lines, or when storms temporarily make inroads on the service. Thoughts of this kind tend to make people more tolerant of public service enterprises, and more appreciative of the service they secure.

Next, following this broad-relationship advertising, if the desire is to increase the number of consumers on the line, house-wiring campaigns should be instituted, the backbone of which is naturally newspaper advertising. Whatever plans may be evolved for having this done, the particulars of such plans should be clearly stated in the advertisements, with the time limit, phone number and address of party to call or address on the subject. Whatever concessions may be allowed during the campaign should be emphasized.

In this and other kinds of advertising the central station should show its belief in advertising by using its own medium—the electric sign. It seems to me no central station should be without its electric sign, blazing forth its message in the night, and "burning in" as it were "the central station" as an enterprise of the community.

The central station should also have a great interest, and generally does, in the disposal of electrical appliances to their customers, not primarily for the profit accruing from the sale, but for future profits from the increased load without increased installation expense. In this connection they find the manufacturer of appliances willing to co-operate to the fullest possible extent in the production of efficient advertising matter.

In the sale of appliances it is generally considered the best plan to have a leader for a given period, and so time the appearance of advertisements in the daily papers so that folders mailed direct to prospects from the consumers' list will make a deeper impression. The manufacturers provide cuts for the advertising of such appliances in the newspapers, and generally folders are provided by some of the manufacturers, and in some cases with the imprint of the central station or the dealer if the appliances are marketed through the dealer.

Direct-by-Mail Advertising.

The one strong feature about mail advertising is the fact that a very select audience can be obtained and an exclusive personal message can be carried to the audience. In a town of 100,000 population a newspaper has probably a circulation of 20,000. An ordinary letter would occupy 50 inches of space and at an average rate of 40 cents an inch cost $20. The postage for addressing every wired house in such a town would amount to about $20, and the total expense for mailing would be less than $60.

One-cent postage will carry a weighty and valuable argument to a prospective customer. Just consider how far an $80 salesman can go for one cent and how long he can talk for that small amount. Such a man costs just about one cent per minute. The mails carry your exclusive message promptly.

In campaign work the mails are vital to success. The monthly bills, if delivered by mail, should always contain some message for improving or extending the service. House organs are a common and successful medium of mail advertising. The expenditure for mail work should probably be 25 per cent of the total advertising appropriation.

I would offer a word of caution against the mailing of more than one folder in any one mailing, and where folders are inclosed with statements at the end of the month it is folly to include more than one folder at a time. In some cases mailings of this kind include from six to a dozen folders, or as much as the postal limits will allow, and the result is that the recipient of such an overload of advertising matter immediately consigns the entire batch to the waste basket, and doubtless in some cases the bill goes along. As in any line, concentration on one article at a time is the surest way to progress.

Importance of Window Trim.

If there is anything in any community which will help in establishing a wholesome respect for the central station and for everything it does and everything it sells, it is a well arranged window setting forth electrical appliances. To this end the central station should be very much interested in the dealers and contractors doing business in the territory. These should be looked upon as active agents of the industry. The more they can be induced to dress their windows and show attractively electrical appliances and the effects of good illumination, the greater will be the results coming from whatever other advertising the central station may do.

Now when you think of window dressing you should not get the idea of great and elaborate windows, involving wax figures, costly backgrounds and all that sort of thing. Many central stations and distributors of electrical goods have lost golden opportunities to be better known in their territory because they have delayed instituting display windows, feeling that all this elaboration was necessary to make the effort successful.

With the opportunities in your hand for illuminating effectively these windows, the filling in of the window remains quite a simple matter, and with the co-operation that is ever extended by the manufacturers, interesting windows can be put in from time to time, much to the edification and enlightenment of your consumers.

A window display is much like a newspaper advertisement. Too much type in an advertisement confuses the eye, repels rather than attracts the attention, and spoils the whole effect. In the same way, too many articles in a window cause confusion in the mind—there is nothing that holds the attention and sticks. A few of the leading articles properly arranged with plenty of space around them to set them off would gain much more attention and produce a far more lasting impression.

The window should concentrate attention on one idea, and that an idea connected with every-day life. As examples, the idea of summer comfort can be used in displaying fans and electric cooking appliances, the idea of light housework would be appropriate for a display of vacuum cleaners, washing machines, electric cooking devices, etc. The idea of electric ironing can be brought out by displaying irons with perhaps an ironing board and clothes basket. The idea of Christmas gifts can be used to display such articles as are suitable for gifts. The main idea can be brought out by a simple hand-lettered card in a conspicuous place. Without a familiar idea to connect with the mind of the passerby, appliances themselves make little or no impression. The more appliances there are without something to connect them with every-day life, the more the eye is confused and the mind repelled.

Bill Boards as an Advertising Medium.

Another means of advertising that is very effective and means much in any community is the billboard. In the smaller community two billboards could probably be made to get the attention of all who live in the community, and where a flood-light effect can be secured by running service to these billboards, such can be made a wonderful mouthpiece for the central station.

It has seemed strange to me that the billboard people and the central stations in the various communities have not co-operated in this matter of illuminating billboards. In many places you will see billboards extended for 200 or 300 feet and all lacking life at night because of there

being no illumination close by. The running of a line to such billboards with the variation of coloring and flashing on and off of light, etc., would make such boards very useful mediums of advertising.

Educating School Children.

Central-station men generally will do well to keep their minds on the possibilities of educating the oncoming generations as to the use of electricity through the public school. And wherever opportunities present themselves for equipping domestic-science departments in public

MOVING VAN
MOVING VAN
Please tell us as soon as possible if you are going to move. This will enable us to promptly disconnect your old, and connect your new, service
The New York Edison Company
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10 Irving Place Stuyvesant 5600
*37 E 125th Street Harlem 6020
*262 E 149th Street Melrose 9900
*Open Until Midnight
Night and Emergency Call: Farragut 2000

How the New York Edison Company Encourages Customers to Notify Promptly in Case of Change of Service.

schools, the central stations should do everything in their power to make it easy to have electric equipment installed.

Motion-picture films have been made by several of the manufacturers which in story form show the many ways that electricity can be used in the home and the wonderful benefits that come from its service. From time to time great good can be done in any community by showing these films to select audiences. Central stations ofttimes borrow such films and either arrange for general exhibitions in different sections of the towns, or else have them shown about before church societies, women's clubs, etc.

How Much Shall Be Spent on Advertising.

There are two right ways of making an advertising appropriation—there are many wrong ways, which need no mention. Any way is wrong that does not permit of planning at least six months in advance. The two right ways of making an advertising appropriation are these: (1) Appropriate a certain percentage of the annual revenue; (2) appropriate a certain amount for each unit of load it is planned to add to the lines.

Of the two methods the first seems to be the more businesslike. It is conservative and entirely rational, and takes account not only of the new business to be secured, but of the old which must be held. I recommend this system. The second system has, however, been successful and may often be used.

The usual appropriation for the first system is from one and one-half to five per cent of the gross receipts. Some of the smaller stations spend as high as five per cent on advertising, while one and one-half per cent for a large syndicate is found to be sufficient. Of this one and one-half per cent, two-thirds is devoted to newspaper advertising.

The appropriation should be considered as an investment, not an expense. If this money be placed at the disposal of a live, well-counseled advertising man, and proper sales co-operation be given, the returns will in general be greater than from other investments, but of course, it cannot rightfully be expected to get 100 per cent return in a single year. A single campaign in a single year will not usually pay for itself, but like any other good investment the earnings will be worth while from the start.

It must be remembered, too, that simply spending the advertising appropriation does not insure a return on the investment. Every purchase made with the money should be closely scrutinized like any other investment.

Calendar Advertising to Stimulate Stock Sales to Customers.

A new development in the advertising campaign of the Northern States Power Company to induce its customers to become financial partners of the company, by the purchase of its stock, is the issuance of an attractive calendar for the year 1917. The illustration on the calendar was evolved from one of the company's recent newspaper advertisements and shows an elderly couple opening an envelope containing a dividend check. Below is the caption, "Here's the Northern States Dividend Check—Always on Time." The dates of January 15, April 16, July 16 and October 15 are printed in red and each of the figures is inclosed in a red circle, these being the dates upon which the regular quarterly dividend is payable.

No other advertising matter appears on the calendar. It is intended to distribute them only to customer-shareholders and to new purchasers of stock so the lack of advertising matter is intentional, it being felt that this will lead non-owners to ask questions, thereby leading to a discussion of the stock with the customer-shareholder.

Electrometallurgical Research Work Assigned to New Government Experimental Station.—The mining experimental station of the United States government, which is to be established at the University of Washington, will specialize in electrometallurgical research work, with the purpose of developing methods for extracting metals from Pacific Northwest ores by means of electricity. Each of the new stations established by act of Congress has been assigned special investigation and research work, the Seattle station being given the entire field of electrometallurgy because of the extensive facilities existing in the Northwest for generating electric power and because there is need of finding the cheapest methods of treatment for ores in that section. The station is to serve the states of Oregon, Washington and Idaho, as well as southern Alaska. Co-operative work will be carried on with the University of Idaho and the Oregon State Bureau of Mines.

Civil-Service Examination for Assistant Examiner Patent Office.—The United States Civil Service Commission will hold an examination on January 17-19, 1917, open to both men and women applicants for the position of assistant examiner in the United States Patent Office, Washington, D. C., at an entrance salary of $1,500 a year. The examination will require three days of six hours each; two will cover physics, mathematics, technics, chemistry, French and German and mechanical drawing. Applicants must be at least 20 years old.

A Civic Duty for the Engineering Profession

Engineers in Their Activities Have Far-Reaching Opportunities to Improve the Character of Our Surroundings by Better Construction Ideals and by Preventing Defacement of Existing Property

By S. E. DOANE
Chief Engineer, National Lamp Works of General Electric Company

DURING the early development of our country the paramount need was to do things, to do them quickly, and in most cases to do them cheaply. All other considerations were relatively quite insignificant.

As an illustration, let us consider the railways. Railways were built, quickly and cheaply, up and down hill, with heavy grades, in some cases as cog-wheel railroads and with switchbacks, and usually with wooden trestles, with single track, etc. A railway at once, even of a temporary character, was better than one of a more permanent nature that would not be ready until several years later.

The same considerations prevailed in other efforts during that period of impetuous development. They prevailed in engineering and mining construction, in industrial operations, in electrical, gas and water supply works, also in the building of cities, and in architecture in general, if that term can be applied at all to some of the earlier building construction in this country.

We have outgrown that phase of our development, but we have not yet overcome the mental attitude resulting therefrom. We are still too much accustomed to do things just somehow, and as yet too little concerned with the question of how to do them so that the result of our action may have a pleasing and dignified appearance. This refers particularly to construction work on public streets and highways.

The lifetime of a community may be compared with the lifetime of the individual. When we are young, we are more unbalanced than in later life. Our first professional education is specialized. The young man just out of college may have a very considerable theoretical knowledge of some particular subject and be well qualified to do good work, providing there is someone of more general experience to direct his activities.

It is also thus with a profession. When it is young, it is characteristic of its membership that they live to themselves. The engineers who have been responsible for the advance of the civilization of the nineteenth century have many times done violence to some of the experiences which civilization has acquired through many years. It is necessary for the engineering community to again learn to apply the general lessons of the old days. One of these lessons is that the appearance of the completed work is a very important consideration in our more mature effort.

Street Lighting a Factor in Appearances.

Of all the engineering activities which have a bearing on the appearances of our streets and landscapes none is nearer to my mind, owing to my daily consideration of its problems, than public street lighting.

The growth of street lighting was necessarily an extension of house lighting. House lighting fixtures were an outgrowth from the hand lamp. When street lighting was first installed, the indoor fixture was adapted for outdoor use and probably the fixture was a bracket fixture. Early street lighting could hardly be called street lighting in the accepted sense of today. The citizens lighted the sidewalk or street in front of their doorways or the doorways of buildings, and as the light from these lamps did not reach very far, the pedestrians carried lanterns to bridge the dark space from one light spot to another. According to our best evidence, when the communities first attempted to light the spaces between one lighted doorway and the next, the bracket attached to the building was generally regarded as a preferable support for the lamp.

THE ENGINEER HAS A CIVIC DUTY

That engineers should endeavor to improve the appearance of our cities, towns and country by their works was the thought expressed by Mr. Doane in a paper presented before a joint meeting of the Cleveland Engineering Society and the Cleveland Section of the American Institute of Electrical Engineers.

Points particularly pertinent to the electrical industry are abstracted from the paper to aid in bringing these ideas to the attention of engineers and in securing their cooperation in performing what is deemed an important civic duty.

Wall brackets are to this day used extensively in Europe and the Orient in narrow streets or elsewhere where they can be employed to advantage. Sometimes the bracket idea persisted even where no suitable building was available to hold the bracket so that it was necessary to erect poles or other construction to carry the bracket. The bracket might be constructed to offer a natural solution for the problem of easy refilling, cleaning, etc., of the lanterns, which normally had to be comparatively high above the street level. The lantern could be suspended from the bracket by means of a rope and pulleys and was thus accessible at any time without necessitating the use of a step ladder. This idea of lowering the lamps from brackets disappeared with the advent of gas lighting on account of the difficulty of conducting the gas to the movable fixture, but when the electric lamp arrived, the idea was immediately taken up again, especially for arc-lamps.

Inconspicuous Lamp Suspension.

The bracket idea for street lighting in narrow crowded streets was not the only one. In the oldest days of public street lighting we find the lanterns hung over the middle of the street on ropes stretched between adjacent houses. The lamps could be lowered to the street level in the same manner as described above for lamps on brackets. The lamps suspended in this manner from cross ropes disappeared just as the lamps lowered from brackets did when street lighting with gas was introduced; here, too, this method of suspension was immediately resumed with the advent of electric street lighting. This type of suspension shares with the bracket type the advantages that it is inconspicuous. The distribution of the light over the center line of the street instead of over the curb line, as with bracket or pole fixtures, is sometimes demanded by local conditions.

A disadvantage is the swaying of the fixtures in the wind, but the advantages may outweigh this. Frequently we even find use made of this type of suspension where the cross-wires are fixed to poles in the absence of suitable houses. Every one of us is familiar with this type of lighting, which is the prevalent one in our suburban streets. I have found one instance at least where this type of lighting with lamps suspended from cross-wires over a very wide street was supplemented by lamps hung from large brackets on the walls of the buildings to light the wide sidewalks.

The third possibility of supporting street-lighting fixtures is provided by the use of upright poles. It would seem that, excepting where the pole to carry the street lamp was desired from an architectural standpoint, poles to carry lamps in the primordial days of street lighting were only used where the bracket or cross-wire supports were not feasible. When one considers the narrow streets, sometimes without any sidewalks whatever, and at best with very narrow sidewalks, this is not at all strange.

Street lighting practice in the old parts of European cities had to work from the opposite end, in a certain sense, as the practice in American and in the younger parts of European cities. Here we have large spaces and wide streets, which imperatively demand the use of pools where no suitable houses are near. There the designer of street lighting has been practically prohibited from the use of poles.

Progress in the Utilization of Artificial Light.

There was a time when all one considered when he thought of street lighting was the appearance of a fixture. The original reason d'être of the fixture was to hold the illuminant, which consisted of some burning matter, whether that was a heap of resinous wood shavings, a pine torch, a candle or an oil-drenched wick, etc. The fixture had originally no further object outside of this. It seems strange, but it is a fact, that the more powerful and efficient the illuminants became, the more attention was given to the efficiency of the employment of light. This led to technical consideration of the construction of the fixture (reflectors and refractors) as well as their proper location.

The psychological examination seems to have been the same as the one for the fact that the wealthier man frequently spends his pennies more considerately than his poorer neighbor. Another explanation of this apparent paradox may be the great general advance of science and its applications during recent times.

It was not before 1744 that street lamps with reflectors were generally used, the so-called reverbères (reverberating lamps) in Paris. This was the first attempt to systematically direct the light of street-lighting lamps into the directions where it is needed and it constituted a remarkable advance in the utilization of artificial light. Another progress of about the same order of magnitude over the earlier reflectors, as these were over the bare lamp is embodied in the new Cleveland "white way" units. The rays of light are not directed by reflection only, but mostly by refraction in a scientific way. So far as I know, this is the first time that this type of fixture, which we must agree is artistically good, has been constructed with the points of engineering excellence which characterize this one. This fixture has been most carefully designed from every standpoint.

Societies Should Accept Civic Obligation.

The purpose of my presentation is to father the thought that the societies represented here should take upon themselves a serious obligation. That they shall diligently and specifically urge that everyone in this city who signs any order for any job whatsoever on our streets or bordering on our streets, shall ask himself this question and shall himself act to best answer this question: *"Will the execution of this order mean a better looking locality?"* If not, rather than sign the order, can we not attempt some construction which will at least do as little esthetic damage to the locality as possible?

Let each one of us have on his mind, whenever we execute a public job, to try to leave a better looking street when done than when we began. It is my desire that what I say shall be constructive. I have pointed out that the type of lantern selected for the ornamental lighting of Cleveland is in accord with the recognized practice the world over and that despite what may be the apparent deduction from some of my later remarks, an ornamental pole carrying such a lantern is likewise proper.

It may be well to mention in anticipation of a later part of this paper the great attention which is given in Europe to the looks not only of the industrial plants as a whole, and to such utilitarian structures as railway stations and their surroundings, but also to such secondary structures as water towers and transformer houses, etc., in the cities as well as in the open country.

The use of the walls of buildings is quite common in Europe for carrying the cross-wires for the suspension of trolley lines and street lighting fixtures. Noise-deadening devices are inserted in the cross-wires of the trolley lines near the wall of the building where necessary.

Where electric lines are not altogether buried in Europe, they are frequently attached to the walls of buildings by means of brackets or to the roofs by means of posts placed on the house tops. Where the lines are carried above the roofs—especially on higher buildings—the conductors themselves are not only out of the line of sight, but the distance itself makes them inconspicuous since thin bare wires only are strung over the house tops; lead cables are not thus used. The lines in this case need not even follow the streets. This still further reduces their visibility from the street.

Where poles are used, their number can frequently be kept down by making one pole do the service of two or three. Instead of using cross-wires for the trolley lines, brackets will be frequently found of advantage and the pole which carries the bracket or brackets can be utilized to carry one or more street-lighting fixtures in addition.

Straight Poles Improve Appearances.

While speaking of poles, let me bring up another point. Where we have poles, why not at least put them up straight? I have seen hundreds of poles in Europe and I do not remember a single one that did not stand as straight as a soldier. Crooked poles apparently are rejected, which is more than we can say with regard to American poles. In Europe overhead lines are always bare and not, like many of them here, covered with an insulation which not only by increasing the diameter increases the visibility of the line, but also after some time partly peels off and hangs down in rags and tatters. Whether an insulation of that kind is an advantage electrically over bare wires is a question by itself. From the viewpoint of appearance, such an insulation certainly is objectionable.

It still is a frequent practice in this country to have the trolley poles leaning away from the pull of the cross-wires (and incidentally in some other direction, too). I have always wondered whether this was really necessary or whether it was just because it had always been done that way. I know now that this is not being done in Europe, or rather that the poles are being put up with an overleaning just large enough that they are pulled into the exact vertical when the tensional stress of the span wires comes on. I know that at least one of the largest firms there constructing electric railroads has provided tables to show how much their standard tubular steel poles will bend under the normal stress to which they are subjected, and this bend in the amount of two or three inches, is to be taken in consideration when the pole is being set, so that the pole stands perfectly straight when the road is finished. For heavier stresses stronger poles are used, although from the viewpoint of strength, the lighter, cheaper poles would be sufficient, but they would bend so much that the effect would be noticeable to the eye. To judge from appearances, the same systematic method is followed with wooden poles.

European Understanding of Civic Duties.

In Europe engineering was developed originally as the product of a centuries-old civilization with which it grew up hand in hand, so to speak, blending in more harmoniously than in either of the other parts of the world. European engineers have had time to acquire a better understanding for these duties, and the people themselves have acquired a clear comprehension for the preservation of the beauties of

their country. Where the development of the industry has been as impetuous as in the case of the electrical industry, it has not always been possible to find an esthetic solution at once for the problems.

Even with this development it cannot be expected that every single engineer realizes his duties towards the esthetic sense of his neighbor and in more than one instance the people in Europe have take it upon themselves to regulate this matter.

In a number of German states, in Bavaria and Saxony, for instance, the people became so conscious of the engineers' responsibility for the looks of the locality that the authorities have issued and recommended certain guiding rules for the protection of the appearance of the towns and the country. They are most excellent and worthy to be taken to heart by American engineers, for they are guilty of having done great and unnecessary damage to the appearance of our country. I quote a few of the most interesting and memorable ones of these rules:

(1) Even with buildings of utilitarian character, such as electric central stations, it will be possible to strike a balance between the utilitarian purpose and the necessary consideration for the appearance of the town and landscape without injuring thereby the economic interests.

(2) The plant will have to be comprehended as a single group of architecture and should be designed in harmony with the character of the landscape. Due consideration shall be given to the native architecture of the respective region and care shall be taken that where possible such building material be employed as is characteristic of the location.

(3) In case of water power plants a part of the water shall be preserved in the old bed of the river, so that the latter does not have a dead or neglected appearance.

(4) Canals look better in the picture of the landscape if they are not traced in rigid straight lines and if their banks are sloped and covered with verdure. It is of advantage to plant willows, etc., on the crests of the banks . . . etc.

(8) In selecting the locations for the poles, care shall be taken that the views of beautiful landscapes, interesting buildings, old trees, road side monuments, etc., be not injured.

(9) Especial caution is necessary when constructing overhead lines in towns. The aspect of the streets can very easily be severely injured by the overhead lines with the drop lines for the house connections and the street lamps. The experienced engineer, however, can considerably diminish this undesired effect by a number of measures. First of all, the lines shall be carried on the back of the houses from roof-supports, and on the more important streets the distributing lines shall be carried on both sides of the street, in order to avoid the frequent crossing of the street by the house connections. A certain compensation for the harmful effect of the overhead lines can be found in using simple street-lighting fixtures of good taste, which very frequently can be suspended over the middle of the street on cross-wires. The latter should not be tightly stretched, but should show a slight sag.

(10) Poles and other supports of the lines should have as little prominence as possible, by their shape as well as their color.

(11) The transformer houses should also be inconspicuous, simple, and of suitable architecture as regards shape, color and material; pure iron construction should be avoided.

I have permitted myself a few occasional digressions in my endeavors to show what the engineer who is not engaged in regular city planning work can do towards beautifying those streets and landscapes which form the scene of his activities or at least towards the prevention of their defacement. On the whole, however, my remarks have been confined largely to the wires of electric light, power and railway systems and their supports, for it is these which are most evident in the down-town business section.

In closing I want to repeat to you the thought which I wish we might each one of us agree to incorporate into our daily rules of practice, to-wit: *that we will endeavor to improve appearances by every job in which we have any part.*

Fuel Investigations of Bureau of Mines.

In the latest annual report of the Bureau of Mines, just issued, Director Van H. Manning says that current practice in the use of fuels is frequently based upon misconceptions as to relative fuel values, the nature of coal and the combustion process, and the method of heat transmission. During the past year work has been completed that makes possible the varying of furnace design in a rational manner, according to the chemical properties of the fuel to be used. Heretofore furnace design has been largely a matter of cut and try, resulting in many uneconomical misfits and in the production of objectionable smoke.

In the combustion investigations the combustion in the fuel bed of hand-fired furnaces burning coal at rates of 3 to 20 pounds per square foot per hour was studied. Tests were made with three kinds of fuel.

A study of the combustion of the combustible substances rising from a furnace bed has been continued in a special furnace having a long combustion chamber. The main object of these experiments is to determine the proper combustion space for burning nearly completely any given coal without producing objectionable smoke. A hand-fired grate was used, and a similar series of tests are being run as with the previously used stoker.

The object of some heat-transmission investigations is to determine the exact relation between the several factors governing the laws by which heat is transmitted from burning fuel to the water in a boiler. A knowledge of this relation will enable engineers to design boilers that will be more efficient as heat absorbers. During the year 1916 a series of 55 tests was made with special apparatus. The factors particularly studied were the influence of initial temperature of the furnace gases and their velocity through the boiler tubes.

Supplementary work done on commercial boilers consisted of a series of measurements of the temperature of gases as they passed through boilers of the following designs: standard Babcock & Wilcox horizontal water-tube boiler, standard Stirling boiler, standard Heine boiler, and double-pass Heine boiler.

Reports complete during the year and submitted for publication included those on combustion in the fuel bed of hand-fired furnaces, combustion of coal and furnace design, the effect of low-temperature oxidation on the hydrogen of coal, and the change in weight on drying, moisture and spontaneous combustion in stored coal, the diffusion of oxygen through broken coal, and the absorption of methane and other gases by coal.

Storage Precautions for Bituminous Coal.

In a bulletin issued by the National Fire Protection Association, Boston, Mass., suggestions are offered for the storage of bituminous coal, to the end that fires originating from spontaneous combustion may be obviated. The present year, it says, more reports than usual are being received of fires from this cause. Safeguards in storing such coal are: (1) To keep storage far from main buildings, and under no circumstances to pile coal against frame buildings. (2) To make piles not higher than 12 feet. (3) To place wet coal at the edges of the pile, so as to get air freely. (4) To insert wrought iron pipe 2 or 3 inches in diameter in the piles as built up, the lower ends of the pipes to be at different heights from the ground; one three-inch pipe to each 400 feet of surface is considered sufficient to allow free air circulation. Preferably the pipes should be perforated.

Safety Requirements of the Toy Transformer

A Candid Discsusion of Possible Hazards Resulting From Use of Toy Transformers of Careless Design—Strong Plea for Making Safety a Prime Consideration

By CHESTER H. THORDARSON

TRANSFORMERS for stepping down 110 volts alternating current of the usual lighting circuit to much lower potential for operating electrical toys have become an established commodity in this country. The rapid increase in the sale and distribution of these transformers in the past few years has been due, to some extent, to increase of battery cost, but chiefly to the wider distribution of alternating current electricity supply to homes.

Although a number of short articles have been written by different manufacturers, wherein each has explained the merit of his design, it is curious to note that a general article on this subject for the benefit both of manufacturers and the public is hard to find. With my very extensive experience in toy-transformer designs, having been one of the very first to introduce one on the market, I feel in a position to give some advice beneficial alike to the manufacturer and the public at large.

Seal Transformers to Protect 110-Volt Circuit.

It may be said that small electrical devices used on a few volts may have no limitations as to cheapness. But it is quite otherwise with the toy transformer that is connected to the 110-volt circuit. There safety must always be paramount and, therefore, such transformers must be very carefully designed. It is of the utmost importance that toy transformers be made as foolproof as possible. Therefore, ordinary screws are most undesirable, as they incite the boy's instinct for dismantling. The 110-volt circuit should be made as inaccessible as possible and, consequently, the transformer case, whether of wood, slate, porcelain or metal, should be so assembled that the boy cannot take it apart without breaking or destroying it.

This is also greatly to the advantage of the dealer, for, in case of trouble, there will be less cause for dispute if the transformer has not been opened. The importance of having goods so well built that they are not apt to come back is being appreciated more and more by the best manufacturers and dealers. Nothing eats up profits more quickly than the return of defective goods.

Desirability of Using Sealing Compound.

The advisability of using insulating compound for sealing the transformer in the case deserves serious consideration. While the use of compound is largely dependent on the size and shape of case, it has several advantages, such as protection of coils from nails and knife blades. The objections advanced against compounds, because of the liability of flowing out of the case when hot, bear little weight since cases can be made to hold liquid compound. It is a fact that compound-insulated coils stand up two to four times longer under short-circuit conditions. This is in spite of the fact that insulating compounds are good heat insulators. The reason is that the short-circuited coil soon melts the surrounding compound and this liquid conveys away the heat. This liquefied compound now penetrates between the layers and turns of the winding and when cooled, provided the short-circuit has not been extended, the winding will show a higher insulation test than before.

There is also less danger of fire when compound is used. A short-circuited transformer can easily ignite its paper and fiber insulations and the fire in turn can spread rapidly to the heated carpet or floor, especially if its bottom be open. The advantages of using compound in toy transformers are, therefore: first, better protection of the 110-volt winding; second, transformer will stand short-circuit for a longer period; third, fire hazard is greatly reduced.

Precautions Regarding the Regulating Switch.

With the great variety of low voltages required for different motors and lamps, the regulating switch has become an established practice. A few manufacturers, however, do not use this switch, but have standardized a one-voltage unit to take care of their different types of motors. However, the transformer built for general service is more flexible if equipped with a regulating switch. Such a switch should always be placed on the top of the case so that the various voltages may be easily observed. A switch placed on the side, while a cheaper and simpler manufacturing proposition, has one disadvantage in that the boy in adjusting and reading is apt to tilt the transformer, which in turn bends the lamp cord at that point where it enters the transformer case. This repeated bending at this point greatly shortens the cord's life. This is a most important point, as the most serious consideration in the operation of the toy transformer is the proper care and attention to the 110-volt cord.

The present practice of using a wide variety of low potentials for operating toys and lamps from transformers is very annoying and expensive to the public and in this practice we hope there will be a great change in the near future.

The toy manufacturers of the United States of America, just organized this year, will undoubtedly render a most useful service to the toy manufacturers, dealers, and the public at large, by establishing standards most suitable for low-potential devices. Such standardization has hitherto been impossible, but, when established, will create simpler and better toys with greater satisfaction to the user.

Special Protective Devices.

A number of toy-transformer protective devices have been devised to guard against short-circuit troubles, such as warning by means of lamp, bell or buzzer. The need of such protection is readily realized, as the train tracks so commonly used oftentimes short-circuit the transformer. Positive circuit-openers seem to be more desirable.

The use of the fuse on the secondary circuit is a very good one and has been successfully tried. As the primary circuit should be in every way inaccessible, the fuse cannot be used on this winding. The most serious objection to the use of the fuse is that the boy will consider he has made a wonderful discovery when he has substituted a strip of metal, nail, or wire, and finds that operation is as satisfactory to him as with a fuse that is continually melting. The manufacturers of transformers with fuses should furnish explicit instructions with each transformer to use the proper fuses, preferably those furnished by the transformer manufacturer.

Undoubtedly, the best protective device is the electromagnetic circuit-breaker placed in the primary circuit and mechanically restored by means of a push button and having its circuit entirely inaccessible. Such a circuit-breaker, unfortunately, cannot be built cheaply, but will undoubtedly be extensively used in the future on the best and most expensive toy transformers.

Danger of Using Binding Posts on 110-Volt Circuit.

We cannot pass over the design of the toy transformers without warning against the danger of using binding posts on the 110-volt circuit. When 110-volt binding posts or other me-

chanical means are used whereby a boy can readily detach a 110-volt cord from the transformer, there is a great liability of danger, as the boy or child is not apt to make a good connection in fastening the cord to the binding posts. There is a special danger of the cord becoming loose, which is most apt to happen if a child lifts the transformer or moves it about when the current is flowing through it. In such a case the wires can separate and cross, and if the hand is near the binding posts it may be seriously burned. We have too many cases of special heavy fuses being used that allow an excessive rush of current from the line in the case of a short-circuit.

Liability of Connecting 110-Volt Supply to Low-Voltage Side of Transformer.

Nor does the greatest danger lie in the short-circuit and burning from same, but rather in the liability of a boy connecting the 110-volt cord to the low-voltage side of the transformer. In such a case the transformer becomes a step-up transformer delivering a potential that can be fatal to anyone touching the secondary circuit when the current is thrown on.

To convince myself what really would happen if a transformer is so connected, I had a small toy transformer, that had been rated at less than 50 watts, tested by one of the largest and best equipped electrical testing laboratories in America. The tests were made with a General Electric oscillagraph, showing the shape of the secondary voltage and current wave on this transformer. The highest potential of this transformer on the low-voltage side was in the neighborhood of 25 volts. Across the high-voltage side a non-inductive resistance was connected corresponding in resistance to the body of a full-grown person.

It was found that on throwing 110 volts on the low-potential side, the high voltage measured 596 volts with one-eighth ampere flowing through that resistance. The lowest secondary voltage of this transformer was about three volts. When 110 volts was switched on this circuit a corresponding resistance was connected across the high-voltage side, which then delivered a potential of 1,140 volts with a current of one-third ampere. The oscillagraph showed a surge voltage superimposed on this voltage that indicated 2,070 volts.

Now, we can easily conceive that children playing with a toy transformer having binding posts or other mechanical methods for connecting the 110-volt cord are extremely liable to this danger. Suppose a child is playing with a track that is connected to the high-voltage side and has its hands across the track. A boy who would then connect the plug or switch on the 110-volt circuit would thereby allow a secondary voltage in the transformer to be produced that would not be less than 590 volts (which is about the highest street-railway potential) and which could be anywhere up to 2,000 volts. Now, as we know that the electrical resistance of the body of a child is very much lower than that of a full-grown person, it is plain that the current that a child would get in this case would be very much greater than these tests have shown. A report of this test can be furnished to anyone sufficiently interested.

With all my extensive experience in designing transformers for extremely varied work, I have never allowed a toy transformer to leave our factory with binding posts or separable connections on the 110-volt side.

General Features of Design.

In this article I have omitted any discussion of the design of the electric and magnetic circuit of the toy transformer, as the best proportions for iron and copper losses, resistance and reactance, are easily obtainable by every manufacturer to suit his best conditions. Also the shape and color of the case, I think unnecessary to discuss. However, this may be said, a toy should always approach as closely as possible that which it is supposed to imitate. Therefore, there may be some argument in favor of a design of transformer that resembles most the real power transformers. However, such a condition is oftentimes expensive and hard to realize.

I have written this article as an appeal for good design and especially for safe construction of the toy transformer, for such a transformer, well constructed, is safer than the ordinary pocket knife and there is no toy that can give better entertainment and instruction to children and grown people all the year around. Toy transformers have come to stay and they will all be made safe and will become a very important factor in home entertainment and instruction.

Parallel Operation of Power Stations.

The English Institution of Electrical Engineers has devoted several sittings of its London and provincial sections to the discussion of the subject of the parallel operation of electric power stations. The commercial questions involved in the linking up of power stations in different districts in the United Kingdom have been fully discussed in recent months owing to the national aspect of the whole matter, as we have shown on several occasions. The object of the Institution meetings, however, has been to consider some of the engineering problems and John S. Peck, who has introduced the subject, has also indicated what types of apparatus are available and the conditions under which they may be used. Fortunately, as he pointed out, the great majority of English stations generate three-phase current at 50 cycles, so that the problem of interconnecting is relatively simple. But there are a number of large systems which generate at 25 and 40 cycles, several generate at 60 cycles, two large stations generate at 33 cycles, while a considerable number generate at other frequencies. These last are principally single-phase systems. The problem of linking up systems of different frequencies is much more complicated than that of linking up systems of the same frequency, and each particular case requires careful consideration in order to determine the best method to adopt. The conclusions arrived at in Mr. Peck's study of the matter are summarized as follows:

(1) Polyphase systems of the same frequency may be connected together directly or through transformers, and operated in parallel without difficulty, but where each station supplies its own customers it is desirable to have some form of voltage regulator to permit independent control of the voltage of each station. If the stations are located in the neighborhood of telephone or telegraph circuits are connected solidly, and have earthed neutrals, provision must be made to prevent high-frequency currents flowing through earth between the stations.

(2) To interconnect a polyphase and a single-phase system of the same frequency a rotating machine of the phase-converter type or a motor-generator is required if the polyphase system is to be symmetrically loaded.

(3) Systems of different frequencies may be interconnected through frequency changers, sets consisting of two synchronous machines or of one synchronous and one induction machine. The synchronous set is usually the more desirable since it permits power-factor control and transmits energy in either direction without a change in the speed ratio between the two systems. It is, however, somewhat more difficult to operate, and to prevent danger from overloading it should have a fairly large capacity with reference to the smaller of the two stations which it interconnects. The induction set is much more flexible, and a small set can be used between two large systems, but it requires a considerable difference in speed ratio between the two systems for transmitting full load, and the induction machine takes wattless current from the system to which it is connected.

(4) In certain cases where continuous current is required the rotary converter may be used with advantage as an interconnecter between two stations of different frequencies, or between an alternating and a continuous-current system.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

NEW BEDFORD COMPANY EXPANDS ITS PLANT.

Large Textile-Mill Load Makes Extensive Improvements Necessary.

The new generating station of the New Bedford Gas & Edison Light Company, New Bedford, Mass., is nearing completion, and equipment is being installed. The new machinery consists of 14 boilers and three 4,000-kilowatt, one 10,000-kilowatt and one 15,000-kilowatt turbines, all of General Electric manufacture. Efficient, up-to-date coal handling apparatus, and the most modern auxiliary equipment are included in the installation.

The New Bedford company is remarkable for the great mill power load it has developed under the management of W. H. Snow. Ten large manufacturing concerns are taking power current, there being the Manomet, Whitman, Bennett, Sharp, Rotch, Page, Kilburn and Dartmouth textile mills, the Pairpont Company and the Morse Twist Drill Company.

When Mr. Snow took the general management the company was selling about 3,000,000 kilowatt-hours of energy per year. With the new equipment in operation the output will be about twice that amount.

Central-Station Company Gives Junior Christmas Party.

An event rather new in the social and welfare work of central-station companies was an "Edison Junior Christmas Party," given by the Commonwealth Edison Company Section of the N. E. L. A. in Customers' Hall, Edison Building, Chicago, on the evening of December 22. Invitations were extended to members of the Section and their families in the effort to provide an opportunity for them to become acquainted. There was an electric Christmas tree, and Santa Claus presented a small favor to each child. The program also included entertainment features especially prepared for the children.

Street Watering With Electric Vehicles.

The success of the electric vehicle for street watering has been admirably proved to the cleansing department of Blackpool, England.

The cleansing superintendent in this municipality strongly believes that street cleaning is one of the most important of his duties, that it is essential for safeguarding the health of the people, and, therefore, the best and most efficient equipment should be secured for this service, regardless of the investment.

In spite of the seemingly large initial cost of the electric sprinkler, figures available at the end of one year confirmed the supposition that a considerable saving over the horse-drawn vehicle had been effected.

The electric which Blackpool has used with such entire satisfaction is a unit of 3.5 tons, with a cylindrical tank, which has a capacity of 750 gallons. The spray operates at the front of the vehicle, thus allowing better control by the driver. Generally this electric watering cart sprinkles about 25 miles of streets in the morning—then the batteries are given a boosting charge of an hour before it goes out to complete the day's work. One of the horse drivers was taught to drive the electric, and they have never had the slightest difficulty. The recharging of the batteries is carried out during the night, and is accomplished in six hours, when the current is automatically cut off.

Further proof of the established efficiency and dependability of the electric watering vehicle is furnished by an order for a second electric of the same type by the Blackpool cleansing department. These two vehicles will allow Blackpool to entirely dispense with 12 horse-drawn wagons formerly employed in their street-watering service.

Electrical Development at Chippewa Falls.

On January 1, 1917, it is expected that the new hydroelectric plant at Wissota Dam, Chippewa Falls, Wis., will be completed and hydroelectric energy supplied to the town. In anticipation of this the commercial organizations of Chippewa Falls are conducting a national campaign to induce manufacturers to locate there, calling attention to the cheap energy that will be available.

The water-power sites on the Chippewa River were acquired sometime ago by the Wisconsin-Minnesota Light & Power Company, a subsidiary of the American Public Utilities Company operated by Kelsey, Brewer & Company, and the development at Wissota Dam will be the first of several similar projects to be undertaken.

A modern dam and power station has been constructed and the ultimate development will be 45,000 horsepower. Transmission to Chippewa Falls will be at 130,000 volts.

Street Scene in Chippewa Falls, Showing Street-Lighting Equipment.

Chippewa Falls, a town of 12,000 inhabitants, is already enjoying unusual electrical development for a community of its size. This is attested to by the fact that there are over 1.5 miles of ornamental street lighting of the latest type. In the matter of domestic and commercial lighting and industrial motor applications there is also a corresponding high development. There are over 35 large manufacturing concerns at present using electricity.

Efficiency of 98 Per Cent Claimed for Electric Vehicle in Store Work.

One of the largest department stores in New York City, of international reputation, has found, from its accurately kept operating records, spread over a long term of years, that the total efficiency of its gasoline delivery wagons, numbering over 100, is between 70 and 90 per cent. The lower efficiency is obtained from small cars of low first cost, while the 90-per-cent efficiency service is secured from the highest type of gasoline delivery wagon.

Contrasted with this relatively low efficiency is the very remarkable percentage shown by the electric delivery vehicles operated by the firm, an efficiency of 98 per cent. Statistics may be rather dry reading, but such efficiency as has been obtained in practice by this department store with its electric-vehicle equipment should greatly interest establishments whose delivery systems are similar.

It is also of interest to note that while gasoline cars, on account of insurance, are compelled to load from the exterior of the building, this firm's electric delivery wagons actually go into the building proper, and through the agency of large elevators, are transported to various floors, at which central points the wagons are loaded, thus saving expensive handling of packages. This simple method of handling the electric vehicle and its contents, which is permissible, owing to the total absence of fire hazard, considerably speeds up deliveries. When the electric vehicle reaches the street a high average speed is maintained, owing to the electric's ability to rapidly accelerate; its simplicity and positiveness of operation making for progress, even under adverse traffic conditions.

When it is also realized that stopping and starting of electric vehicles for delivery purposes does not impose any particular hardships on the simple mechanism of the electric, and that when the electric is at rest no energy is being consumed, and the aforementioned efficiency obtained in actual practice is also taken into consideration, it is not difficult to understand why concerns who carefully record operating data should extensively employ the electric vehicle.

ITHACA GAS & ELECTRIC CORPORATION MOVES INTO NEW OFFICE BUILDING.

Feature of New Building is Auditorium for Use of Public, Equipped with Electric Kitchen and Other Conveniences.

The Ithaca (N. Y.) Gas & Electric Corporation has moved into its new office building, and is now comfortably housed in one of the finest and most up-to-date buildings, devoted exclusively to the business of a public service corporation, in the country.

For many years, the company occupied a wooden structure at this same location, which had been reected some hundred years ago. This building became unsuited for its purposes, and in addition was a serious obstacle to the progressive spirit which is being evinced by the company. The new building is not only splendidly equipped for the purposes of a public-service corporation; but is at the same time an evidence of the company's civic pride in the city of Ithaca.

The new building is three stories in height; is of modern fireproof construction throughout, and has already earned the name of a "Building without Shadows," three sides being almost entirely constructed with windows.

A number of innovations, unique in the gas and electric industry, have been embodied in this building. A notable one being the construction of a ladies' rest room on the main floor for the use and benefit of the public. This room contains telephones, a lavatory and a rest room, splendidly furnished with easy chairs, writing table, etc.

The cashier and information departments are also located on the first floor, and the remainder of the space is utilized for the display of gas and electric fixtures and appliances. This floor is of tile, with marble baseboards, the showcases being built around the various pillars.

The second floor is devoted exclusively to offices, the executive, accounting, engineering and new-business departments being located on this floor. The laboratory also has its headquarters on the second floor.

The third floor is dedicated to, and for the free use of, the various ladies' organizations of the city of Ithaca, the auditorium seating approximately 250 people. A model kitchen has been provided on this floor, and a gas range, incinerator and a water heater are connected. In addition, the company furnishes the necessary dishes for any social that the ladies may have when they might wish to do their own catering. This auditorium is absolutely free to any organization which might wish to use it, including, of course, the free use of gas, light and heat as well as the piano and motion-picture machine furnished by the company.

The third floor also contains shower baths for the use of the employees. Combination gas and electric lighting fixtures are used on both the second and third floors. Fireproof vaults have been constructed from the cellar up to the second floor, and Bell inter-office telephones are used.

Pittsburgh Company Striving to Break House-wiring Record.

In order for the Duquesne Light Company, of Pittsburgh, to exceed its record for 1916 in the number of old houses wired, it is necessary for the company to secure 2,400 contracts before January 1, 1917. Under the direction of Howard H. Wood, superintendent of the wiring department of the company, strenuous efforts are being made to achieve this result and the co-operation of all of the employees of the company has been secured.

The accompanying advertisement is being used in the daily papers, and also for distribution among the employees, showing a special offer on the wiring of a six-room house, including fixtures. Mr. Wood reports that present indications point to the desired number of contracts being secured and attributes this success, in a large measure, to the co-operation which is being secured from the employees in interesting their friends.

Unusual House Wiring Offer
Six-Room House Wired for Electricity, With Complete Set of Solid Brass Fixtures, $69.75, Payable $9.25 Down and $5.50 Per Month for 11 Months
¶ These fixtures are first-class in every particular, and are exclusive in this offer. They are of solid brass with brushed brass and black finish.
¶ The set includes:
¶ Living Room—Four light electric shower, solid brass, with canopy and pan and shades to diffuse and soften the light.
¶ Dining Room—Three light electric shower, solid brass. Very artistic.
¶ Hall—One light electric ceiling fixture, solid brass. Etched shade. Not large but very attractive and in harmony with the exquisite design of the other fixtures.
¶ Kitchen—One light electric stem fixture, solid brass, oxidized or copper finish, with glass reflector.
¶ Second Hall—Similar in design to first hall. White shade.
¶ Two Bedrooms—One light electric fixture in each, solid brass, either pendant from ceiling or as wall bracket. Brushed brass and black finish. Attractive etched shades.
¶ Bath Room—Fixture same as bed rooms.
¶ All wiring will be done by the most expert wiremen and with the best of material. No damage to ceilings, wall paper or woodwork. We make a specialty of wiring old houses. All switches are of the standard push-button flush type, with solid brass plate.
¶ This bargain proposition for a six-room house is merely a sample. Proportionate prices for additional rooms and fixtures.
¶ Don't miss this bargain. We invite you to inspect this set as well as a complete line of other types of electric fixtures at our Fixture Department, Kirkwood and Whitfield Streets, East Liberty, one square from Highland and Penn.
¶ Call Wiring Dept., Hiland 6700, for further information.
Duquesne Light Co.
Living Room
Hall
Bath or Bed Room
Kitchen
Dining Room
Bath or Bed Room
Hall
Bath or Bed Room
Flush Switch

Advertisement of Duquesne Company.

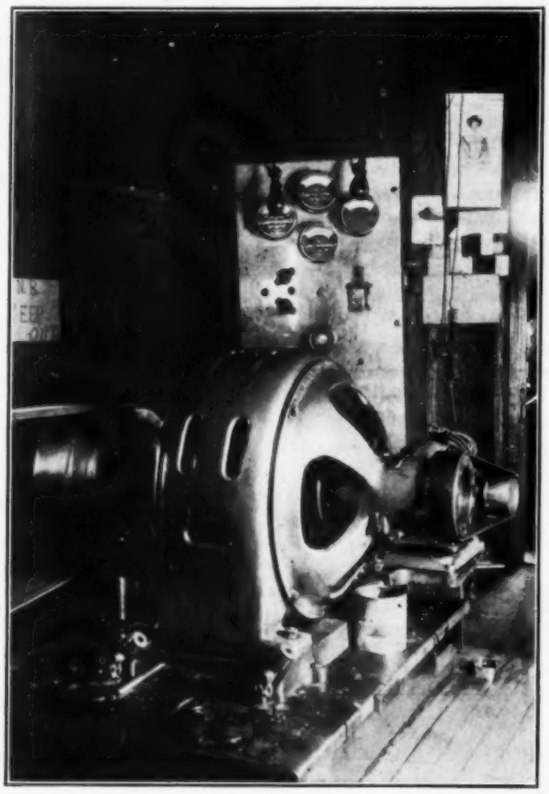
Ins and Outs of the Electric-Lighting Business

Being the Experiences of the Manager of a Small Electric Lighting Plant, Which He Rehabilitated and Put Upon a Paying Basis

By E. V. LAUGHLIN

THE electric-lighting business is by most people considered extremely prosy—a business that once established will run itself. Some of these misinformed folks characterize it as a "snap." They say that all the manager has to do is to switch lamps on and off, read meters once a month, string a little wire occasionally, oil and repair dynamos and other machinery, and do odd jobs of varied character, for which he is highly paid. Occasionally some reluctant investigator will admit that a certain measure of business instinct is required in connection with rendering and receipting of statements, collecting doubtful accounts, and reaching out for new business. These more discerning friends, without asking the manager very much about it, conclude that the selling of electricity requires much more business sagacity than the *making* of electricity.

The truth is that selling illumination is a sort of double-action business—the manager being both a manufacturer and jobber. Not only must this individual be keenly alive to opportunity, be constantly hustling for new business, but he must as well constantly consider the manufacturing end of his business. Never was there a greater mistake than the one, strangely rather common, that the electric-light man does not need to be much of a business man, and that if he has a thousand dollars or more of capital that he is bound to make money. This erroneous notion probably grows out of the fact the electric-light manager, except in the larger towns, has practically a monopoly on the output.



Generating Equipment in a Typical Small Central Station.

The conclusions just enumerated are not those of the writer's, but are the gleaned experiences of a manager who has for five successive years been selling "bottled sunshine" to the people of his community. In this article this manager will be known as C. R. Jones—Charley Jones. The writer knows that he is making a success of his business, and that his lighting plant, year by year, gives better service and that the people whom he serves are appreciative of his efforts to give them what they want in the way of illumination. While the account that follows is intended primarily for electric light managers, there are, nevertheless, features of it that may be taken home by any business man. In other words, the business discoveries of Mr. Jones are applicable anywhere in the business world.

Vigilance the Price of Success.

Jones is something of a business philosopher. Listen to what he says about selling electricity: "Yes, I believe I am making a success in my undertaking. My patrons complain very little, and the income upon what I have invested furnishes me a good living. My plant is now pretty fairly equipped, and I feel that my organization might be a great deal worse. Nevertheless, I realize that the golden rule of business—eternal vigilance—applies to me as well as to anyone else, and that there can be no relaxation if efficiency and income are to be kept level or raised. For several years now I have had this principle continually before me, and I am sure that it, in a large measure, accounts for my success. I believe that all manufacturers—I count myself as one—must accept it and abide by it if their business is to make the desired growth. The price of success in any manufacturing or commercial undertaking is found in the word 'vigilance.'"

The writer, when he listened to this bit of philosophy, could not help but think that Charley Jones had hit upon the keynote of business success. Jones' entrance into the electric-lighting business was not an altogether easy matter; in fact, the experiences are sufficiently unique to be worth repeating. Twenty-five years ago his father, a rather adventuresome man in business matters, concluded that the home town offered unusual possibilities for the establishment of an electric-lighting plant. In addition to an unusually progressive lot of business men, he reasoned that the small college in the town would help in sustaining the business; accordingly he converted an old mill into a power house, enlarged the dam upon the creek nearby, purchased his dynamos, strung up some wire, and advertised electricity for sale. At first he succeeded nicely. But, being inexperienced in operating a power plant, coupled with difficulty in regulating his water power regularly, induced so many breakdowns and interruptions of service that much of his initial patronage dropped away. The merchants either went back to oil lamps or established gasoline or acetylene outfits. His near friends candidly told him that he was not cut out for operating a lighting plant. Being a determined man, however, he persisted in keeping the plant running. Enough of his friends charitably patronized him so that he about managed to keep even with the game. Whether there was much loss the son never knew, for many of the old gentleman's transactions were memory affairs; besides such books as were kept were a sort of potpourri of the half-dozen things in which he was interested. It was in this troubled condition that the plant came to the son a little over five years ago.

Gaining the Favor of the Public.

"I have learned since that I was not very well liked in my home town when I took charge of the lighting plant, due to the fact that I had been away for a good many years, and somehow people had the notion that I was haughty and unsociable. I was at this time as unconscious of this as I was

of the fact that many people purchased energy from father merely because they were sorry for him. I was aware when I looked the plant over that it was a pretty sorry affair, but it seemed to me that there ought to be good money in it if it were modernized and operated upon a strictly business basis. The A-B-C of the lighting business I had learned through working in a modern plant in a thriving western town, though my initial experience had been secured in the plant of which I was now the owner many years before. As soon as I had made a careful inventory of the possibilities I announced to those who quizzically asked me what I expected to do with the plant that I expected to continue the service and to improve the plant in several ways. I told them that a part of my plan included the installation of steam power to be used when the creek could not be depended upon, and the lengthening of the hours of service. I hinted that I might eventually maintain entire day service if sufficient power might be sold to meet the added expense. I have since learned that these innovations were freely ridiculed and my bankruptcy freely prophecied.

"I had a few thousands of available capital, and I was helped in establishing a reasonable credit at one of the local banks. The high rate of interest prevailing in my state and the need of renewing my notes every three months made it imperative that I avail myself of the bank credit just as sparingly as possible. This was probably a good thing, for it checked my tendency to plunge too deep at first. It was apparent to me after meeting a few interest payments that it was highly desirable that the plant be built up out of the profits. The reluctance, too, with which people subscribed for service was rather discouraging. I wondered at this, and down deep in my heart muttered a good deal about the lack of co-operation seemingly existing in the town. As explained before I did not know that myself and my business were generally discredited."

Building Business by Popularizing Service.

It is in this rather modest way that Mr. Jones describes his start in the business. If he were pressed he would also explain how the first few months were pretty strenuous ones, and how there were times when he did not get over three or four hours of sleep a day; how he made it a rule to answer all the hurry-up calls on the run; how he extended the morning hour for commencing service to four o'clock to accommodate early risers, and the hour for shutting down to one o'clock to please stay-ups. All of these items were put into operation as rapidly as the profit would permit, and greatly tended to popularize the service.

People generally admire grit and push. Within six months the citizens of the town forgot to criticise the efforts of the new manager, and here and there champions appeared. One by one the gas systems disappeared, and business men asked to be connected with the lighting plant. Private homes were quick to follow. The college which had installed gasoline a few years before came into line, thus considerably increasing the income and giving the plant an added prestige. The local town aldermen, without solicitation, voted street lights, thus adding the weight of official favor. Within three years the plant was brought up to a creditable standard of efficiency. Every cent of the profits, except the necessary family living expenses, went back into the business. The engine was kept steamed up ready for use if for any reason the water should fail. Old, obsolete machinery was punked, and modern installed. At the present time the plant is valued at about $30,000. The monthly income is about $500, one-half of which is paid out in wages, repairs, and improvements. It is thus seen that Mr. Jones clears about $3,000 annually, which is not a bad income in a town of 900 population.

"Skeptical people said I was foolish when I talked of establishing 24-hour service. However, I had my own ideas on the matter. By dint of much persuasion I prevailed upon the editor of the local paper to install electric power; but he did and I thus secured an extra income practically enough to pay for the added labor. This editor now tells me he doesn't know how he ever got along without his motor. The same is true of the grist mill owner whom I persuaded to install a motor. Today my patrons would raise an awful howl if I talked of discontinuing all-day service."

Good Service Obtains Confidence of Patrons.

In these words Mr. Jones tells how he won the confidence of his patrons. Good service was the secret, as it is usually the secret of all successful undertakings. At the present time the day service has become not only self-supporting but profit-producing. A little less than 100 electric irons, 25 grills and 15 motors are daily fed from his power plant. The electric cooker is being advocated, and Mr. Jones feels that in a short time a number of these will be installed. Shrewdly he suggests that the approach of warm weather, when housewives begin to dread the hot stove, is the time the electric stove is best exploited.

Experienced electric plant managers may read this article and be interested in knowing what his rates are. For their information the following facts are given:

Residential Rates.—For 10 kilowatt-hours and less, 15 cents per kilowatt-hour; 10 to 20 kilowatt-hours, 12.5 cents; 20 to 50, 10 cents; 50 and over, 9 cents.

Commercial Rates.—For 30 kilowatt-hours and less, 12.5 cents; 30 to 80, 10 cents; 80 and over, 9 cents.

Power Rates.—For 300 kilowatt-hours and less, 8 cents; next 200, 7 cents; next 100, 5 cents; 600 and over, 4.5 cents.

Distance of power plant from center of town, one-half mile.

Capacity of plant, 75 kilowatt-amperes.

Entire number of patrons, 180.

Number of families in town, about 200.

Number of merchants in town, 30.

Courtesy in all business relations is a feature upon which Mr. Jones lays great stress. In his own dealings he says that the provocations for losing one's temper are many and often extremely exasperating. Especially is this true with respect to reading the meter. In this respect his experience is that the manager is accused of being an adept at trickery. The average patron looks with suspicion upon the meter's readings, and is sure that some serious mistake has been made.

The following was one of his most trying cases. The son of a professor in the college, a young man greatly interested in electricity, but who was withal very careless, fixed up a resistance coil for experimental purposes but forgot to detach the contrivance when going away for the summer. To the astonishment of both Mr. Jones and the professor the latter's bill—it was in July when electricity consumption was shrinking—footed up four times the usual amount. He met a very indignant response when he called at the professor's home to investigate. Later this quick-tempered individual accused him in public, and would not listen as the cause of the large consumption was explained. Mr. Jones kept his tongue and returned only a laughing reply. Being a gentleman at heart the professor, when he had thought it over, apologized and assisted in recalling his hasty accusations. Mr. Jones feels that his honor is unstained, and that he has a friend where otherwise he would have an enemy.

Honesty, courtesy, eternal diligence and vigilance, progressiveness, these Charley Jones believes to be the elements of success in the electric-lighting business.

Commonwealth Edison Output Exceeds Five Million Mark.

For the first time in the history of the Commonwealth Edison Company, of Chicago, the total 24-hour output of the company exceeded the five million mark, when the total figure reached 5,047,703 kilowatt-hours on Friday, December 15, 1916. The previous high record occurred the preceding day, December 14, when 4,991,726 kilowatt-hours were registered. The highest output for any one day last winter occurred December 24, 1915, with 4,550,137 kilowatt-hours.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

LAYING OUT SWITCHBOARDS AND PANELS.

By Harry B. Stillman.

In laying out switchboards, there are so many varied complications and exceptions controlling each particular job that it would be impossible in a short article to offer any comprehensive suggestions. Each job is in a class by itself, and must be worked out according to the actual requirements as they arise. The following hints are not intended to cover the whole field, but are presented merely with the idea in mind that perhaps they may hit a few of the high spots here and there. The few points touched on, however, have been found by experience to be important in a great many layouts of medium or small switchboards and special panels of relatively simple design.

The slate should be laid flat, as shown in sketch No. 1, on a box or barrel with a clear space on all sides to allow plenty of room to work on either side without the back-aching job of bending or reaching across from one side to the other. Mark the top side of the slate *Top* with either chalk or pencil, and lay out the switches or instruments accordingly. Any man is subject to "that tired feeling" who is trying in vain to mount an instrument on the board rightside up, when the spacing in the slate has been drilled upside down.

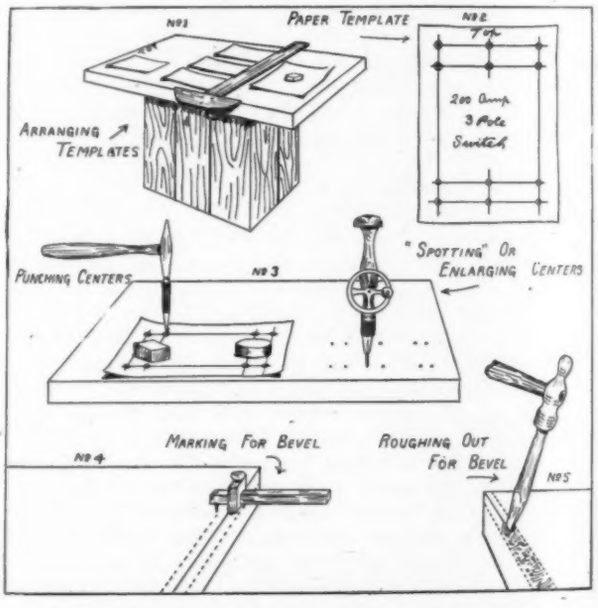
If you have neither drawing nor blue-print specifying the location of each particular switch or piece when mounted, a good plan would be to make a paper layout or template of each switch or instrument to be mounted on the board. In other words, mark off to full scale on smooth and not too thin paper the correct spacing or measurement for each hole to be drilled, as shown in sketch No. 2. Each layout or template representing a switch or instrument must be plainly marked what it is with its amperes or capacity and the size holes to be drilled in the slate. If there is more than one switch of the same capacity, one template will answer for the lot, by moving it along on the board after marking for each switch.

All these templates may be moved or changed about on the slate, somewhat similar to playing checkers, until you have them finally placed to the best advantage. Bear in mind, however, before the final decision as to exact locations is made, that a straight line is the shortest distance to a given point, and arrange the locations of the material on the front of the board that will mean a saving in labor and material in the busbar construction on the rear. This important feature of looking ahead of the game and planning each future connection in advance is as necessary to the successful switchboard man as the brass buttons on a policeman's coat. A more accurate alinement of the template may be accomplished by working from a chalk line, marked from center to center of the slate, or by using a T-square. The templates may be held in place with paper weights of any description.

Punch a small pin-like hole through the paper into the slate, placing the punch directly into the centers (sketch No. 3), or the spot where both center lines intersect and hitting the punch a light blow with the hammer; this leaves a small pin-like impression in the slate, which may be enlarged by using a small drill one-sixteenth or one-eighth inch in diameter operated by hand in a small-size breast drill (see right end of sketch No. 3). Four or five turns of the handle will increase the size of the impression large enough to catch the point of the larger drill, when drilling. This last operation is called "spotting," and gives better results than if the drilling was done directly from the first punched impression only, which is a rather small bull's eye to attempt to hit with a large-size revolving drill that is very liable to circle around the center and finally slide off to one side. This means to the man who is vainly trying to mount the material on the front of the board, a lot of filing, also a generous flow of language that wouldn't look well in print. A little care in centering the drill at the start may spare considerable labor when the board is to be assembled.

Any markings on the slate should be done with an ordinary lead pencil or chalk. A copying, indelible, or styleographic pencil leaves a greasy mark which is very apt to show up after the board is enameled or oiled.

Beveling of the slate should be done after the drilling is completed, as a bevel would greatly interfere with a T-square when arranging the template previous to laying out the slate. Mark the slate where the bevel is to come with a carpenter's gauge adjusted to the width and depth of the bevel required, as shown in sketch No. 4. Mark the line good and deep on the face and edges of the slate. For the actual beveling, use a coarse file or a wood rasp, the cutting to be done with the outward stroke of the file. A heavy or deep bevel may



Suggestions for Laying Out Switchboards and Panels.

first be roughed out with a chisel (sketch No. 5). This is rather a ticklish job, however, and should be undertaken only by a careful man. If his feet don't slip and he is on the job perfectly sober, he ought to do a very satisfactory job. A neat and accurate bevel is an important feature on any switchboard. It is more pleasing to the eye and relieves the harshness of the usually chipped square edge of the unbeveled board.

Compensation Insurance for Contractors

A Discussion of a Form of Protection That Is of Particular Importance to Electrical Contractors

By GEORGE W. HILL

AN EMINENT authority has stated that as early as the year 1500 B. C. the Jewish law provided that "if a master were the means of causing a loss, either intentionally or unintentionally, of the eye or of the tooth of his slave, he was bound to let him go for his eye's or his tooth's sake," and again according to the same law, if an employer allowed his ox to gore either his servant or a stranger, he was required to pay various compensations to the injured, if he survived, or to his relatives in the event of the injury being followed by death.

Under the ancient Roman law this general doctrine of liability prevailed in one form or another, whereyer law and order formed a part of the social system.

Under the feudal system of the middle ages the master was virtually the owner of his servant, and he was not directly responsible to such servant for negligence, but, on the other hand, he was answerable in alms to persons injured through the neglect of his retainers.

The liability of employers in damage for injuries or death suffered by their employees, or other persons through the negligence of their employees, has been in fact a part of the law of most nations.

Origin of Limitations.

Gradually, however, there appeared various qualifications of this broad principle, always in favor of the employer. Among the earliest and most important of these limitations was this, that no injury can be done to one who willing consents to it, and this is perhaps the origin of the far-reaching and important doctrine of contributory negligence.

In Great Britain under the common law the employer was liable for the acts of his employees, except that under the doctrine of common employment a workman injured by a fellow workman had no recourse against the common master.

The earliest recorded English decision on the question of negligence was rendered by Lord Halt in 1704 in the famous case of Coggs vs. Barnard, wherein the learned justice defined negligence as consisting of three degrees, namely, gross, ordinary and slight. However, until 1846 the representatives of a workman, who had sustained a fatal injury, had no right to recovery against the employer.

By the terms of Lord Campbell's act, passed in 1846, the executor of the deceased had the right to sue for damages within 12 months after the death of the injured; by an amendment to the act, passed in 1864, it was provided that, if the executor failed to begin suit within six months after death of the injured, the beneficiaries or any of them had the right to commence such action.

Early Compensation Legislation in England.

It was not until the year 1872 that any definite legislation was attempted, providing for compensation of employees in case of injury or death. A bill introduced into Parliament that year as well as the measures brought forward practically every year thereafter were suppressed until the year 1880, when an employer's liability act was passed to take effect on January 1, 1881, and to continue in force until December 31, 1887, unless otherwise determined by Parliament. This act was applicable to laborers, railway employees, miners, and in fact, to all persons engaged in manual labor, except domestic or menial servants. An amendment to the act passed in 1897 made it applicable to servants also.

The rule that the master was responsible for injuries suffered by his employees, as well as any personal injury sustained by a third person due to the wrongful acts or omission of his servants, acting as such and within the regular scope of their employment, became subject to three important exceptions.

These were: first, that if the person injured and the one causing the injury were fellow servants, the master was relieved from liability for the injury; second, if the person injured had actual knowledge or means of knowing and of understanding the hazards incident to the employment and then voluntarily accepted the service, he was deemed to have assumed all the usual and ordinary dangers of the task and in case of injury resulting therefrom no recovery could be had against the master; third, that if by his own negligence he contributed to the accident, he could not recover against his employer.

Development of Modern Ideals of Compensation.

To Germany belongs the credit of first introducing the modern system of workmen's compensation. It was brought about primarily by the vast changes which had taken place in the industrial conditions, especially the growth and development of the factory system. These changed relations between the employer and the workman fostered and aided the socialistic movement, particularly among the working class.

The German compulsory accident insurance bill was passed July 6, 1884, and became effective October 1, 1885. In the beginning the compulsory insurance law applied only to the more hazardous industries, but was rapidly extended to cover other and less dangerous trades until today practically every workman is protected under the law.

Austria was the second country to adopt the modern principle of workmen's compensation, the law becoming effective in November, 1889. The first British workmen's compensation act of the present liberal type was passed in 1897 and covered employment in factories and dangerous trades. France followed in 1898, and since then Norway, Italy, Hungary, Holland, Russia, Spain, Belgium, Denmark and Sweden have all adopted the principle.

Workmen's Compensation in the United States.

The United States has been one of the last countries to substitute the principle of workmen's compensation for employers' liability. The Congress passed an employers' liability law relating to interstate common carriers on April 22, 1908, and a workmen's compensation law for accidential injuries, resulting in disability or death to employees of common carriers, such as railroads engaged in interstate or foreign commerce in 1912.

The State of New York passed the first comprehensive workmen's compensation law in the United States in 1910. This law applied to workmen engaged in manual or mechanical labor in certain hazardous trades, and the basis of liability was the trade risk of the accident. This law was declared unconstitutional by the Court of Appeals of the State of New York, March 24, 1911, on the grounds that it deprived the employer of his property without due process of law.

New Jersey was the next state to pass a compensation

law in 1911, and since then Kansas, California, Illinois, Nevada, New Hampshire, Ohio, Washington, Wisconsin, Michigan, Massachusetts and several other states have enacted this legislation. The present year finds other states in the union either putting similar laws into effect or planning to do so.

General Principle of Modern Workmen's Compensation.

Under this modern scheme of compensation for work accidents, the doctrines of contributory negligence, assumption of risk and fellow servant have no place. As soon as an industrial worker becomes incapacitated through injury received in the line of his duty or the course of his employment, a certain compensation provided by law is assured him.

The only exception should be when the injury is caused by the serious and willful misconduct of the workman. In such cases the compensation should be disallowed unless the injury results in death or serious and permanent disability.

Importance of Workmen's Compensation to Contractor.

There seems to be a tendency on the part of many contractors to disregard compensation insurance, while as a matter of pure business judgment it would seem that one of the essential things to do is to provide ourself with such protection as can be afforded by this kind of insurance. In most states where such workmen's compensation laws are operative, a contractor or other employer who elects not to operate under this law, deprives himself of all of the common-law defenses and he is usually hopelessly swamped when he is so unfortunate as to be the employer of an injured workman.

The writer believes that the law of compensation to the injured workman is a just one, viewing it from the standpoint of both the employer and the employee. The amounts stipulated are in many cases much more than the injured might receive under the common law after paying attorney's fees (which frequently are on the percentage basis, in most cases the larger percentage going to the attorney rather than the injured party) and allowing for the possibility that appeals may be taken and the case carried from one court to another, with the further possibility that not withstanding the employee or other injured person may be justly entitled to compensation, technicalities may creep in and the case be finally thrown out because statutory limitations have expired. While operating under the compensation law there seems to be a disposition on the part of those making and enforcing such laws to give the workman what would seem a most just compensation. Viewing it from the standpoint of the injured employee, it seems only just and fair that he be protected from the knavery of the many jack-knife and incompetent lawyers, who may see at the beginning a large enough fee in one single case to justify keeping an office open for a whole year or possibly may have visions of a touring car. It is through the practice of scheming attorneys that such large amounts are frequently asked for small injuries and which make it doubtful whether anything at all will be recovered.

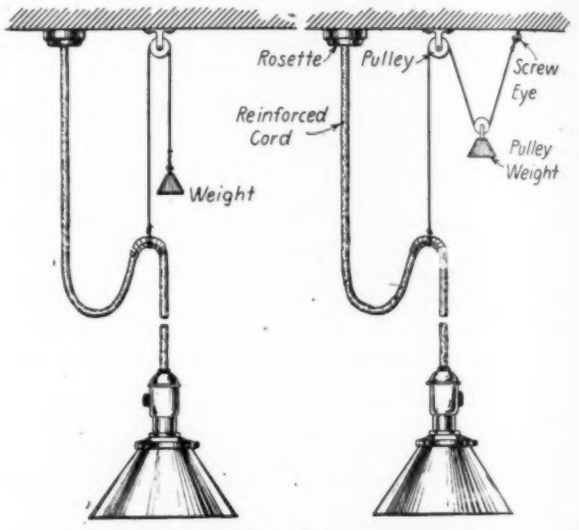
Proper Charging Off of Liability Insurance.

The liability insurance cost is an expense which should be distributed throughout the entire year's business in the overhead percentage added to the cost of productive labor and material; it is only this way that this burden is placed where it belongs. The customers of any business should be required to bear the burden of all reasonable operating expenses incurred in the conduct of such business or profession, plus a reasonable profit. While a large percentage of the expense incurred in any business is looked upon as a natural and just charge, is it not just as natural and material that those employed in any business or profession be cared for in case of temporary or permanent disability due to accidents or even sickness and old age?

The writer believes that we have just begun to see the light and to realize more and more our responsibilities toward one another in this country and that the next 25 to 50 years will present industrial problems which will bring us more and more to a realization of the fact that some equitable compensation must be provided for those who have contributed to the well being of this great industrial world and have finally become incapacitated either through accident, sickness or old age. Then it will be when the average business man will come to a better understanding of the perplexing problem of overhead or general operating expense, the lack of knowledge of which makes it impossible to set an intelligent selling price.

Improved Home-Made Cord Adjuster.

The cord adjusters frequently used with drop lamps are objectionable because they cause the cord to be chafed and rapidly worn so that it is liable to be short-circuited. The general requirement of re-inforced cord meets this objection partly. The accompanying sketches show a simple form of



An Improved Home-Made Lamp-Cord Adjuster.

cord adjuster that can be easily made and that I believe will meet the requirements in that it can be used with re-inforced cord and that it does not bend the cord sharply nor cause it to be chafed. It also has the advantage over most cord adjusters in that there are no springs or anything else to get out of order. A strong, smooth twine should be used to run over the pulley. The counterweight should practically equal the weight of the socket, lamp and shade, plus the weight of the cord between the socket and point of attachment of the twine. At this point the lamp cord should be well taped to prevent the twine slipping or cutting through. For a longer adjustment or the same adjustment with the weight higher up, use the double-pulley arrangement shown at the right.

Arthur P. Nickerson.

Among the Contractors.

The Cascade Gas & Electric Fixture Company, Seattle, Wash., has been awarded a contract for additional fixtures in the King County Court House, at $5,987.

The Wyoming Electric Supply Company, Sheridan, Wyo., has removed to larger quarters made necessary by increasing business. The company will have an electric fixture display room, as well as space for repairs and battery charging.

CORRESPONDENCE AND DISCUSSION

A Reader's Page Wherein Opinions on Topics of General Interest May Be Expressed

Safeguarding Electricity in the Home.

To the Editor:

The criticisms of Mr. Fletcher on this subject in your issue of December 2 are timely and must be of interest to the manufacturer as well as user of electrical appliances, likewise to the manufacturer of electricity. It is undoubtedly true that the rapid increase in the use of electricity industrially as well as domestically and the great increase of current-consuming devices at such prices as places them in the hands of all classes of people increases the possible dangers and abuses to which electricity may be subjected. While the recommendations as to grounding instead of insulating advanced by Mr. Fletcher are admirable, so far as safety is concerned, their attainment is not always feasible because of financial or physical reasons.

Grounding of Metal Cases of Portable Devices, Etc.

The Bureau of Standards in its Bulletin No. 54, entitled "National Electrical Safety Code," recommends the grounding of metal frames of portable devices, the grounding of exposed non-current-carrying metallic parts of all lighting fixtures and other fixed electrical fixtures when located in damp places or when within six feet of exposed metal piping, radiators, plumbing fixtures, etc. The Bureau further recommends individual grounds or earths at the individual building services and specifies the resistance of the grounds. The limits recommended are from five ohms for circuits not exceeding 10 amperes in capacity to one-tenth of an ohm for circuits of 500 amperes. Such low resistances can in nearly all cases be obtained only in one way, namely, by connection to the underground water-piping system.

It is not always possible to connect to the water pipe, for such is not always present, or if present may not be metallically connected to the main system. In such cases artificial earths must be resorted to. In this connection it should be remembered that in obtaining protection not only is it necessary to possess a low-resistance ground connection, but to obtain and maintain a uniformity of potential between the neutral point of the secondary system and the earthed metallic structures on the premises comprised by the service.

That it is highly desirable to ground exposed metallic frames of portable appliances, and the exposed non-current-carrying parts, cannot be denied. That it is hardly feasible at the present time to do so, except possibly in isolated instances, also permits of no argument. The difficulty in doing so would be removed were wiring standardized and polarity plugs in vogue, and the one side of the secondary invariably grounded. The danger then would be limited practically to faulty cords.

Use of Separate Cords With Standardized Polarity Plugs and Receptacles.

At present when one purchases an electrical device or appliance, a socket or plug and cord are usually included as an integral part of the purchase. In many cases the cord is not what is wanted because it is too long or too short. Would it not be far preferable to eliminate the cord and plug as part of the device, equipping it instead with suitable terminals for the reception of a socket?

This is supposed to be an age of standardization. Standardize the terminals of current-consuming devices for the different capacities. Standardize the cords and plugs and sockets. With standardized terminals on the portable devices, with the one side of the circuit connected rigidly to the frame and this same side in turn connected to the terminal which will fit into a definite pole of the polarity plug, and with the wiring standardized, the difficulty in the way of grounding the frames of portable appliances will be overcome. Standardization of cord lengths, and selling them separate from the devices seems desirable. If cords were made in standard lengths of 6, 12, 20 and more feet, the one best suited to any purpose could be obtained without needless cost and the annoyance of lost time which invariably results. Another advantage of keeping the cord and the appliance separate as individual pieces of apparatus is that the local electricians and supply houses would in many cases attend to the supply of the cords, thus removing a rather annoying transaction from the central-station company, by removing its need for repairing defective cords.

Hazards of the Toy Transformer.

In discussing the safeguarding of electricity in the home it would not be amiss to mention one piece of apparatus which is coming into increasing use in divers ways, and which really does appear to constitute a very probable hazard. I refer to the toy transformer. There are toy transformers now upon the market which lack conspicuous means for differentiating between primary and secondary terminals. Both sets of studs or terminals are exposed, and the marking specifying which terminals are to be connected to the supply circuit is not readily discernible. Some of these transformers have a movable arm which permits of varying the secondary voltage.

In the hands of a child or a person not conversant with electrical apparatus it is a very easy matter, and one that is excusable, to connect the low-voltage side of one of these transformers to the 110-volt supply. To do so steps the voltage up instead of down, of course, and thus 110 volts may be transformed to a dangerous voltage, 2,000 volts or so. With 110 volts impressed upon a winding designed for three or more volts saturation of the iron occurs, and the induced wave-form is no longer a sine wave but peaked. In such a case an electric shock may easily prove fatal, and in any case dangerous.

There are many toy transformers in the hands of youths and in the playroom. They are looked upon as useful in that they teach the uses and exemplify the safety of electricity. Actually they, at least some of them, constitute a very real hazard. That accidents, if not fatalities, have not already occurred is due to good luck rather than forethought in making them safe. While a general discussion of design is uncalled for here and would serve no useful purpose, it can be said that the terminals of the primary, high-voltage, or 110-volt winding should be so brought out and designated, for example by permanent connection to a cord and plug, that there will be no incentive or excuse of accidentally connecting the transformer other than the way in which intended.

Of course, inverting the toy transformer and connecting the low-voltage (low-resistance) coil to the high-voltage supply circuit should cause the fuses to blow. But this takes time and often the fuses are larger than they should be, whilst a shock may occur practically instantly.

Responsibility on Central-Station or Dealer.

It would assuredly appear advisable for the central-station company or the retailer to issue a word of advice before selling toy transformers to the layman, and young persons

especially, warning against the danger of using the transformer inverted to step up instead of step down the voltage. The onus of imparting this warning rests with the seller, morally as well as legally, it would seem.

There is still one other matter, no doubt realized but seemingly forgotten, which deserves passing mention. As the central-station company is sometimes judged by the meter readers it employs, whether they are insolent or polite, so also is the company frequently judged according to the standard of current-consuming devices sold by it. The failure of an electrical appliance in a time of need to many represents the failure of electrical methods and of the company whose business it is to supply it. Certain classes of customers cannot discriminate, others do not care to, and thus the central-station company earns discredit and appliances come into bad repute. While the central-station company is not directly to blame, because it is the appliance, not the supply system, which has failed, it cannot be held entirely blameless because of possibly having taken insufficient care in recommending an inferior piece of apparatus.

The past high prices of many electrical appurtenances, and the need for inexpensive ones, has tempted some to enter into the business of making appliances which will find a ready market. Some of these devices have been found unreliable, uneconomical and unsafe, because they have been marketed by persons looking for immediate gain by sacrificing the future of others. Time will, of course, eliminate such products and they will thus find the oblivion they deserve. Meanwhile harm is done and loss of prestige suffered by those who do not exploit the industry for personal gain. It behooves all who strive to popularize the use of electricity in the home, the factory and elsewhere to do so in a way that will stand the test of time. One is judged by what one sells, and as one values one's name, too great care cannot be exercised to sell only what is worthy.

Evanston, Ill. L. R. Montgomery.

Life Hazards From Electricity and Other Agents in the Home.

To the Editor:

The use of electricity in the home is now becoming so universal that any fatality resulting from its use must necessarily be of general interest. The comments of F. S. Fletcher in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 2, in which reference was made to the electrocution of a woman in Chicago, give rise to thoughts which may be sufficiently germane to justify mentioning them.

Difficult to Determine Cause of Death.

Electrocutions in the home are, fortunately, of but rare occurrence, judging by statistics. This may not, however, necessarily be the case, for death may be due to electric shock and yet not be recorded to that effect; on the other hand, a death may be charged to electrocution whilst it is really due to natural causes. These statements are not made with any animosity against the medical profession or with the intention to casting any reflection upon it. Electricity is, or is supposed to be, such an unknown quantity, so mysterious and wonderful, that if circumstances are at all favorable or suggestive it may be blamed for a death, and a verdict so found meets with ready sanction by a certain section of the press and public which delights in being enabled to place the burden of responsibility upon the public service corporation for anything and everything to its disadvantage.

Electrocutions, whether occurring in industrial plants or in the home, are so comparatively uncommon that when they do occur the medical fraternity called in on the case may be unfamiliar with the phenomena resulting from electric shock. On the other hand, the persons familiar with the electrical phase of the matter are ignorant as to the effect of dynamic current upon the anatomy. In two instances to the writer's knowledge—neither of them in Chicago, however—has death been attributed to electrocution because circumstantial evidence was suggestive, whereas it was quite easily ascertained at a post mortem examination that death was due to natural causes.

Characteristics of Electrocution.

It is not always easy to pronounce definitely the cause of death. Electrocutions by high-voltage high-capacity circuits are usually quite apparent because of flesh burns from the arc or pin-prick punctures at the surface of the flesh where the current enters and leaves the body. Thus diagnosis is reliable without further examination. A careful examination shows, however, that biochemical changes have occurred in the blood, its coagulability and the fibrinogen and fibrin having been destroyed, also petechial hemorrhages of the serous membranes and, less frequently, extensive hemorrhages of the structures in the direct path of current flow. When the body has been subjected to heavy current for an appreciable length of time, in addition to charring at the surface of the flesh, intense internal heating, notably in the cervical portion of the spinal cord and oblongata, will be found also.

It is a different matter in cases of electrocution in the home. The current is usually small, that is to say of low intensity, and exists but for an instant. The pin-prick punctures and burns so conspicuous in the former case may now be absent and examination may fail to find any radical anatomical changes. Death has in all probability been due to respiratory paralysis, contraction of the heart muscles and capillary hemorrhages. In any case it requires a post-mortem examination to determine the cause.

The writer's experience, admittedly somewhat narrow, of electrocutions in the home shows that the bathroom is the place where the chief danger lurks. This is partly due to the fact that electric fittings and the water-pipe system are usually in such close proximity to each other, and partly because the bathroom is the place where one would in the ordinary way use such appliances as the vibrator, etc., upon the naked body and over the cardiac region. There is still another reason, and an important one, why electrocutions in the home might be generally expected to occur in the bathroom, and that is because at such times—after a bath—the body is least able to withstand the effect of an electric current, since the body is damp from steam and moisture and the heart somewhat weakened. The after-bath effects upon a weak heart may alone suffice to cause death without being augmented by an electric shock.

Usual History of an Electrocution.

The history of an electrocution in the home generally is somewhat like this: The victim is found unconscious upon the floor, where he may have lain several minutes or several hours. In the same room is the bath or radiator and any one of the various electrical appurtenances within easy reach. On arriving upon the scene, it is found too late to attempt artificial means of resuscitation, and thus the first precious minutes have been lost. The room may or may not have been disturbed, probably the former, for it is a domestic tragedy and the principals know not what they do. Circumstances may point to electrocution, although conclusive evidence is lacking, without a post-mortem examination critically carried out with a particular purpose in view by one who knows what he is attempting to determine. The victim's relatives probably object to the requisite examination for sentimental reasons and thus death may be charged to natural causes or to electrocution, either one rightly or wrongly.

Meanwhile the authorities, civic or public service, or both, make tests to determine the earth resistance at the service, the condition of the transformer and the interior wiring, etc. The findings of the physicians and of the engineers may or may not agree, while the victim's relatives remain in doubt, and the statistics become of questionable value.

Conditions are not always as bad or doubtful as the above, of course, depending upon where the accident occurs. It would appear to the advantage of the public service companies, the

public and the physicians, were the rather scant data relating to electrocution in its various phases compiled and made available for general reference. Doing so would possibly enable the public utility to protect itself against well-intentioned but inexperienced persons, upon whose statements claims for damages may be formulated, whilst it also would enable the relatives of a victim to obtain their due.

Relative Magnitude of Electrical Life Hazard.

In discussing the dangers of electricity in the home, the question arises, what is the danger? The use of electricity is increasing; its cost is decreasing; the various ways in which it may be used are increasing. Electricity is still something of a luxury, although a necessity more or less. Increased luxury usually gives rise to increased hazards. Familiarity breeds contempt, and thus the hazards of electricity in the home might be expected to increase. But what are the hazards?

While not attempting to belittle the danger of electrocution in the home due to making simultaneous contact with the electrical fittings or circuit and the water pipe system or its equivalent, it may be interesting and very enlightening to compare the fatalities in the home from divers causes, and particularly from electricity and illuminating gas. The following statistics are obtained from the report of Peter M. Hoffman, coroner of Cook County, in which Chicago is situated, and refer to the year 1915.

Statistics from Cook County, Illinois.

During the year there were 1,247 domestic tragic deaths in the home, that is to say deaths from other than natural causes, and 2,501 deaths outside the home, a fact which rather controverts the familiar impression that the home is such a safe place. Of the deaths in the home, 228 were due to asphyxiation, 170 to burns and scalds, 161 to falls, and 508 to suicides, of which 243 utilized gas. There was *one* death by electrocution. In the year 1915 there were roughly about 675,000 services for gas and less than half this number for electricity in Chicago. Comparison upon this basis is not equitable, however, since the coroner's statistics apply to the whole of Cook County, which has a population about 10 per cent greater than that of Chicago.

A study of the deaths from gas, and the manner in which they occurred is instructive. Of the 459 deaths last year by gas asphyxiation in the home (including suicides), 116 were due to open gas jets, 18 to detached or defective hose, 17 to open range or burner, 17 to water heater generating carbon monoxide, 10 to use of gas by intoxicated persons, 9 each due to use by aged persons and defective fixture, 8 to combination electric and gas fixture, 6 each, defective supply pipe and homicide, 5 to hanging clothes on fixture, and others due to extinction of gas by wind, frozen pipes, and similar causes.

An analysis of these fatalities shows that the majority of them could have been prevented by the exercise of care. Care requires effort. A number of deaths were due to the carelessness of others than the victim, and were in fact beyond the latter's control. Of the 243 suicides, perhaps not a few would not have occurred had not such a ready means of self-destruction as gas been available, on the supposition that the cause for the act was a transitional abnormal mental condition.

Electricity Comparatively Extremely Safe.

There was only one death by electrocution. Electricity does not poison the atmosphere with a gas which cannot be detected if pure or by persons in deep slumber or with defective sense of smell. It cannot be blown out by wind or by the boiling over of liquid, nor will it create a very real hazard if interrupted without turning off. The life of the person using it is not at the mercy of other careless or culpable persons in the same building. The use of gas in the home is dangerous, the use of electricity safe.

It is, however, better to be careful than sorry, and I believe all of us should preach against the practice of making simultaneous contact with the electric fittings and conductors and the water-pipe system, not because it is dangerous to do so, but merely inadvisable. Electrical construction and operation have not yet reached the ideal. Apparatus is not yet perfected, and we do not live in a Utopia. But the use of electricity in the home instead of gas is desirable, because it is safer, healthier and more desirable in every way.

Chicago, Ill. Ivor L. Kentish-Rankin.

Proper Sizes of Conductors for Induction Motors.

To the Editor:

In your issue of December 16, 1916, there appeared an article by Mr. Hazlett on the proper sizes of conductors and fuses for induction motors. As a whole, the article is excellent and timely, but the author is mistaken in his interpretation of Rule 8*c*, fine-print note under the fifth paragraph. The table under this note, giving certain percentages of full-load current for various sizes of motors is not a requirement, but is merely a suggestion, as is clearly stated in the fine-print note, which reads:

"In the great majority of cases where A. C. motors of the above type are started by means of autostarters the current-carrying capacity of wires meeting the rule will not exceed the following percentages of the full-load currents of the motors."

The author takes these suggested percentages as mandatory, and then because the motor leads, according to this interpretation, work out in some cases as unreasonably heavy, he apologizes for the Code, and states that the Chicago Electrical Code is more reasonable, as it requires only 50 per cent overload capacity for branch conductors. As a matter of fact, the National Electrical Code is much more reasonable than the Chicago Code, since the National Code requires an overload capacity of only 25 per cent for motor leads, except in those cases where, owing to the type of motor, its installation or use, conductors must be heavier than this to be protected by the larger fuses found necessary.

Rule 8*b*, fifth paragraph, is very explicitly worded, and reads as follows:

"Conductors carrying the current of only one motor must be designed to carry a current at least 25 per cent greater than that for which the motor is rated. Where the conductors under this rule would be overfused, in order to provide for the starting current, as in the case of many of the alternating-current motors, the conductors must be of such size as to be properly protected by these larger fuses."

There has been so much written on this subject and there seem to be so many misinterpretations of the Code requirements for wiring alternating-current motors, that I feel that the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN should make a special effort to assist in clearing up this subject.

R. P. Strong,
Chief Electrical Inspector, Louisiana Fire Prevention Bureau.
New Orleans, La.

Easy Pole Construction Along Railroad Embankments.

To the Editor:

In the December 2 issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN there is published on page 977 an article entitled "Easy Pole Construction Along Railroad Embankments." There is, in this practice, a serious menace to life and limb due to the rails being pulled out of alinement or a train approaching when there would not be sufficient time to remove the line or chain from the rail. I know of a case where the rails of a siding were used in a similar capacity and pulled out of alinement, but fortunately the defect was discovered before the siding was again used.

As I am interested in matters pertaining to safety, this is brought to your attention in connection with the "Safety First" campaign now under way.

Brooklyn, N. Y. C. T. Mortimer.

NEW APPLIANCES

A Weekly Review of the Latest Developments and Current Information Respecting Electrical and Kindred Mechanical Appliances

Stewart Electrically Operated Scrubbing Machine.

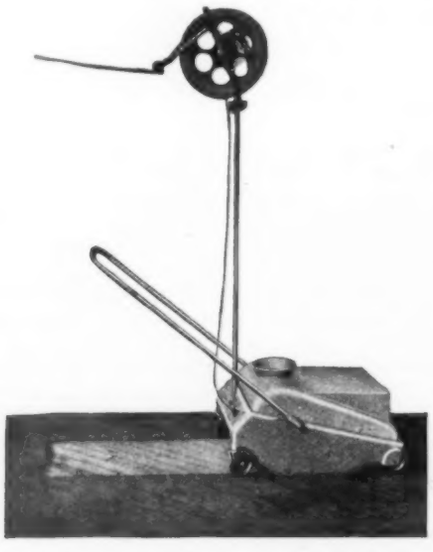
The applications of electricity for relieving both man and woman of tedious work and drugery are gradually being extended. One of the most irksome duties connected with housework, as well as the keeping tidy of large buildings and institutions, is the scrubbing of floors. Not only is this a laborious and disagreeable task, but it takes a great deal of time to go over a large surface of flooring with scrub brush or even with a mop.

The solution of this problem is the electrically driven floor scrubbing machine. A device of this character which has been tried out and found very satisfactory is illustrated herewith. It is known as the "Sanitary Stewart" and is manufactured by the Dale-Rey Corporation, 150 Lafayette Street, New York City. The machine is entirely self-contained and, considering its large capacity, is quite compact. Its dimensions are 28 inches long, 20 inches wide, 16 inches high. The weight of the outfit is 100 pounds. The entire machine is made of metal except the revolving brush. The upper portion of the machine consists of a tank for holding clean water.

The machine wets, sweeps, scrubs and dries the floor at a single operation. It requires only a single attendant who merely pushes the machine forward and guides it. He controls the amount of water distributed on the floor by means of the handle. This water is immediately swept up by the cylindrical brush which is 16 inches wide and has a circumference of 20 inches. This brush is driven by a one-fourth-horsepower motor through a Morse silent chain and sprocket so that the brush revolves at about 600 revolutions per minute. The brush does the actual scrubbing and carries all of the dirt and soiled water over an apron into a separate receiving pan so the scrubbing is always done with clean water from the upper tank. An upright is attached to the machine which carries a cord reel at the top to permit of taking in and letting out the cord by means of which it is connected to any ordinary lighting outlet.

This machine has an extraordinary capacity. It has been found that if the attendant pushes the outfit forward at a rate of one mile an hour, it will scrub an area of nearly 7,000 square feet per hour. This is about ten times as much floor area as an experienced janitor can scrub clean in the same length of time. Where the floor is very dirty, or the capacity of the machine is to be compared with the work of a person not very experienced in handling a scrub brush, the superiority of the machine is even much greater. Not only has this machine exceptional capacity, but it leaves the floor much cleaner and more evenly scrubbed than can be done by hand. It is well known that most ordinary manual scrubbing or mopping results in chiefly smearing the dirt over the floor and removing only a portion thereof. The machine does not allow the floor to become soaked with moisture and it dries the floor very quickly, thus making for efficiency as well as sanitation and long life of flooring.

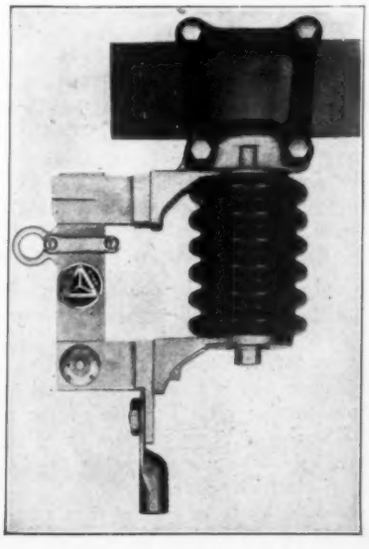
Naturally the greatest field for a machine of this type is in cleaning corridors, halls and large rooms in public buildings, office buildings, etc. In such places the janitor work is usually done at night. Because the machine cleans the floor so rapidly, it results also in considerable saving in current used for lighting the premises during cleaning.



Electrically Operated Scrubbing Machine.

New Bus-Type Disconnecting Switches.

As central-station capacities increase additional precautions must be taken to guard against accidents which will cause complete shutdown. A practice rapidly growing in favor is to place disconnecting switches in series with the busbar side of high-tension oil circuit-breakers or switches, so that when it becomes necessary to adjust or inspect the breaker mechanisms this can be accomplished without danger to the operator. Another useful feature is that, should the oil breaker prove defective or develop



New Bus-Type Disconnecting Switch.

short-circuits within itself, the trouble can be localized by opening the disconnecting switches.

The new type of disconnecting switch illustrated is made by the Delta-Star Electric Company, Chicago, Ill., and designed to clamp or mount directly on the bus, thus securing a high space-factor. The adjustable contact and holding clamp enables the switch to be so located that a short run is secured to the oil-switch terminal.

Constant-Current Closed-Circuit Arc-Welding System.

Arc-welding practice, as it exists today, is based on operation of arcs from constant-potential circuits, and since arcs operated under these conditions are unstable, it is necessary to connect a ballast resistance in series with each arc.

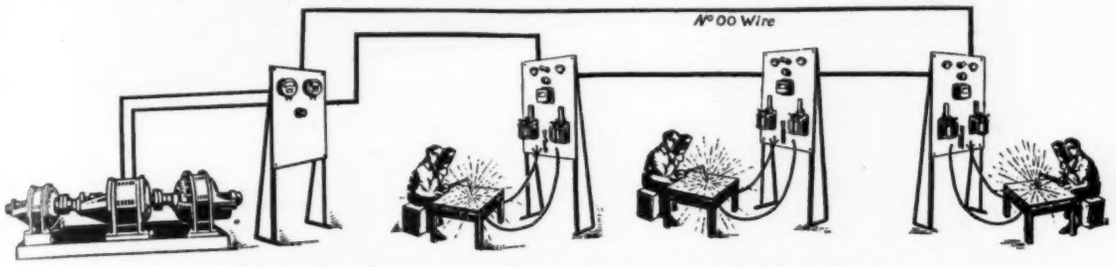
In the early days, comparatively high-voltage circuits were used and enormous quantities of energy wasted in resistance. Later, as arc welding became of greater industrial importance, generators were constructed especially for the purpose, and the voltage was made as low as possible, until finally it has settled down to from 60 to 70 volts.

A normal welding arc consumes about 22 volts. However, depending upon the operator and upon the work, it may vary from 18 to 28. Therefore, any voltage produced by the generator in excess of this must be absorbed in resistance and wasted.

The constant-potential arc when operated in multiple with other arcs, requires a separate circuit from the generator end of the line, or at least from a point in the distribution system where the voltage regulation is close, otherwise the coming on and the going off of the various arcs will disturb the regulation to an intolerable degree.

The Electric Welding Company, electric welding contractor, which has been in the electric-welding business for nearly ten years, developed in its practice a new system of arc welding and, in order to place this system on the market, organized the Arc Welding Machine Company, 220 West Forty-second Street, New York City, as a separate corporation. This corporation has perfected the system now known as the constant-current closed-circuit system, which operates arcs in series.

This method has all the advantages of series distribution, namely, the size of wire is uniform throughout the system and carries a uniform current, independent of the length of the circuit as well as of the number of operators. The circuit is simply a single wire of sufficient cross-section to carry the current for one arc, run from the generator to the nearest arc, from there to the next, and so on back to the generator. Whenever it is desired to do welding, a switch is inserted in the line, and a special arc controller provided with suitable connections is plugged in across the switch whenever work is to be done. These controllers may be made portable or permanently mounted at the welding stations.



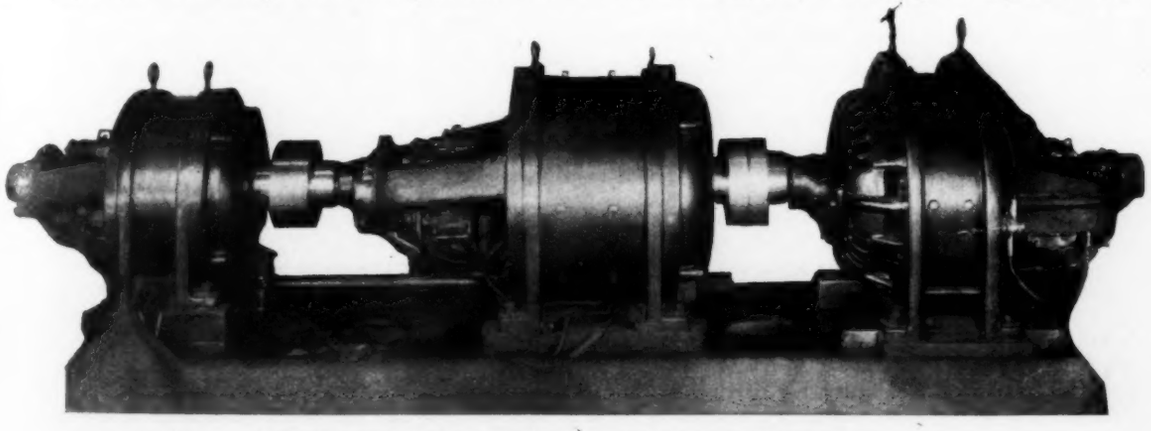
Simple Scheme of Wiring Constant-Current Series Arc-Welding System.

The generator is a special machine and consists of two units, the generator proper, which furnishes the energy for welding, and the regulator, which automatically maintains the current at a constant value. The regulator is excited from a separate source, and by varying its excitation with an ordinary field rheostat, the main welding current may be set at any value within the range of the machine that is desired, and once set it will automatically maintain that value.

Each arc that is operated on the system is equipped with an automatic controller, which serves two essential purposes: (1) It maintains at all times the continuity of the circuit, so that one arc cannot interfere with any of the others when it comes on, or goes out of, the circuit. (2) It controls automatically the heat which can be put into the metal of the weld.

The current through the arc, together with the size of pencil or electrode, determines the flow of metal from the pencil, and this current is adjusted by shunting any desired portion of the main current around the arc. The regulation characteristic of the arc is adjusted by a series-parallel resistance, which is patented.

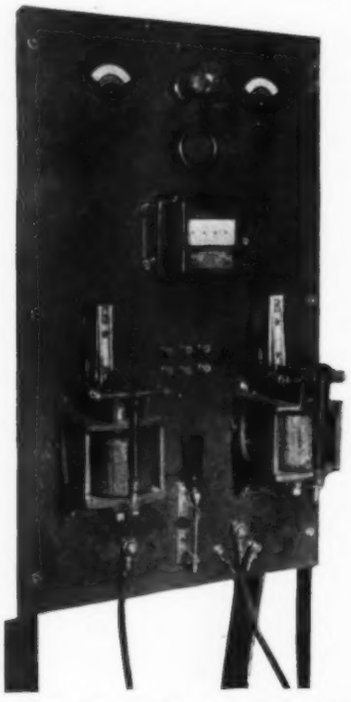
For a given flow of metal through the arc, the temperature of the metal is determined by the length of the arc, that is, by the voltage. With this controller the length of the arc limited by the voltage is adjusted to suit the



Motor-Generator Set for Constant-Current Arc-Welding System.

work and the operator and, if exceeded, the arc is short-circuited automatically, and remains short-circuited until the welder is ready to begin again.

Provision is also made for stopping the arc at will without lengthening it. Therefore, with this system it is claimed to be impossible to draw a long arc and burn the metal and, most important of all, the arc is not broken when the welding operation is stopped, but is killed by a short-circuit which is placed across it.



Control Panel for Constant-Current Arc Welding.

Stopping an arc by short-circuiting and limiting the heat production in the same way is also patented. A great step in advance has been made by short-circuiting the arc instead of breaking it, because it is impossible to avoid leaving a crater with pin-holes by any other means than reducing heating of the metal, and this is the most effective method of doing it.

On account of the fact that the arc heat is automatically controlled and limited, it is possible to use a lower grade of labor in welding operations with this system.

The number of arcs that can be connected in series is limited only by the voltage and up to the present time 12 is the maximum number for which machines are constructed.

Rix Motor-Driven Pump and Air Compressor.

The water supply for automatic sprinkler systems for fire protection is usually furnished to the sprinklers at a certain pressure. While part of the pressure may be obtained by elevating the tank, it is not always possible to elevate the tank sufficiently to provide the pressure required. By means of the outfit shown in Fig. 1, the water for the sprinklers is pumped to the tank and the necessary pressure maintained partly by elevation of the tank, but mainly by means of an air compressor comprising part of the outfit. This outfit, which is made by the Rix Compressed Air & Drill Company, San Francisco, Cal., consists of a pump and a compressor, both of which are operated by the same motor. A five-horsepower direct-current or alternating-current Westinghouse motor is used, connected to the outfit by gears. The motor is so arranged that it can be shifted by means of a handwheel (shown at the extreme right of the illustration) so that the motor-pinion will engage either with the gear that drives the pump end, or with the gear that drives the compressor.

The same company is also placing on the market the small motor-driven air compressor shown in Fig. 2, for use in garages and service stations to furnish free air service to automobile owners. The compressor, which is air-cooled and has a capacity of 2.5 cubic feet of air per minute, is belt-driven by a one-half-horsepower Westinghouse motor. The latter is controlled by a pressure switch which is usually arranged to start the motor when the pressure in the tank falls to 125 pounds and stop it when the pressure reaches 145 pounds. A storage tank is furnished with the compressor. This tank is made of seamless steel tubing, tested for 2,500 pounds per square inch.

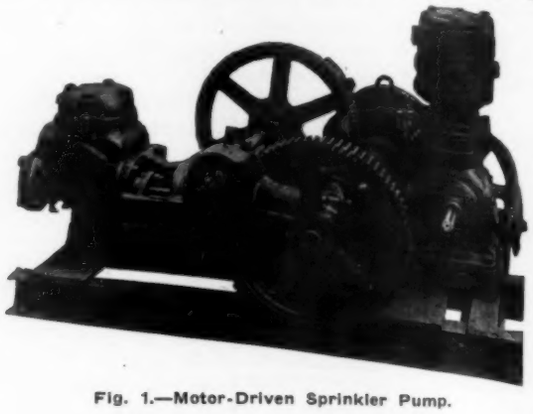


Fig. 1.—Motor-Driven Sprinkler Pump.

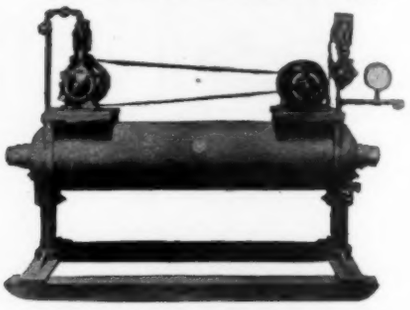


Fig. 2.—Motor-Driven Air Compressor.

The Johnson Transmission-Line Tap Clamp.

The rapid extension of power transmission lines in all parts of the country has been made possible in no small degree by the development of relatively inexpensive outdoor switching and substation equipment. This has stimulated further developments in simple and low-cost auxiliary equipment to facilitate installation and maintenance.

A device in this class is the Johnson transmission-line tap clamp, illustrated herewith. This clamp is capable of a number of uses, particularly on live lines.

The outfit consists of two main brass parts, of which Fig. 1 shows the front and spring part and Fig. 3 the back and contact part. The relation of these parts is better shown in the side view, Fig. 2. The contact part has an eye near its top by means of which the whole clamp is placed on or removed from the live line, a switch stick being used for this purpose; at the bottom of the contact part is a hook for putting the device down over the wire; directly above this hook is a lug into which the connecting lead is soldered or fastened with a set screw. The two parts are held together by strong non-corrosive springs.

For manipulating these clamps two forms of switch stick are provided; these are shown in Figs. 4 and 5. The former is a simple type with hooks for engaging the eyes on the tap clamp. The stick shown in Fig. 5 is designed especially for mounting the clamps or removing them from live

high-voltage lines; it has a special safety head operated by means of an insulated cord for this purpose. In applying the clamps to a line the end of the connecting cable is first connected to the dead apparatus, line or ground which is to be connected to the live line. The connecting cable is then secured to the cable lug on the clamp and the latter placed on the hook of the switch stick by passing the latter through the eye at the top. In this manner it is very easily placed over the live line where it hangs suspended due to the weight of the connecting cable. The hook is then removed from the eye and inserted in the loop at the bottom of the clamp; then by a downward pull the clamp is securely snapped onto the line, the powerful springs insuring a grip that makes as satisfactory a connection as if the connecting lead were soldered to the line. If the clamp is to be removed from the line, the hook in the switch stick is again engaged into the eye of the clamp and pushed upward.

From the foregoing it is evident that these transmission-line tap clamps are especially suited for making live connections without interrupting service. They are particularly suited for use on transmission lines up to about 50,000 volts, and are proving of great service to power companies. For example, the Georgia Railway & Power Company is using these clamps for installing transformers, meters and switches in its outdoor-type substations. It has been found by this company that not only do these clamps permit the ready removal of any of these units without interrupting service to the power customer, but that they reduce the cost of installation very decidedly, in one case a saving of 90 per cent having resulted in the installation of an outdoor-type oil switch.

When repair work is to be done on a live transmission line, safety requires that the line be thoroughly grounded before the linemen begin work. For this purpose a special form of grounding clamp, shown in Fig. 6, has been devised to be used in connection with the Johnson tap clamp already described. This ground clamp is intended for connecting the ground wire or cable to one leg of the steel tower commonly used for transmission lines, being secured thereto by a strong set screw.

These devices, as well as a line of Johnson transmission line strain clamps, are being placed on the market by Hickey & Schneider, 61 Broadway, New York City.

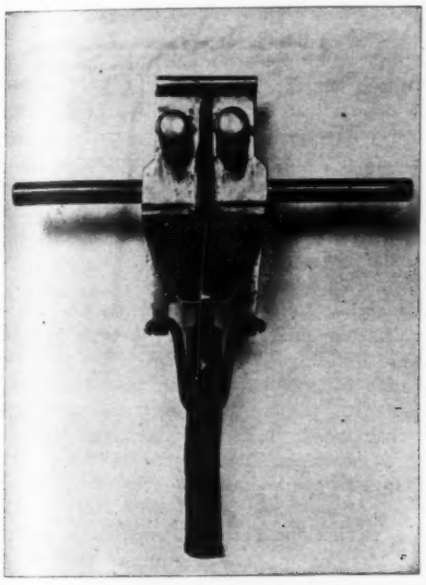


Fig. 1.—Front View of Johnson Tap Clamp.

Fig. 2.—Side View of Clamp.

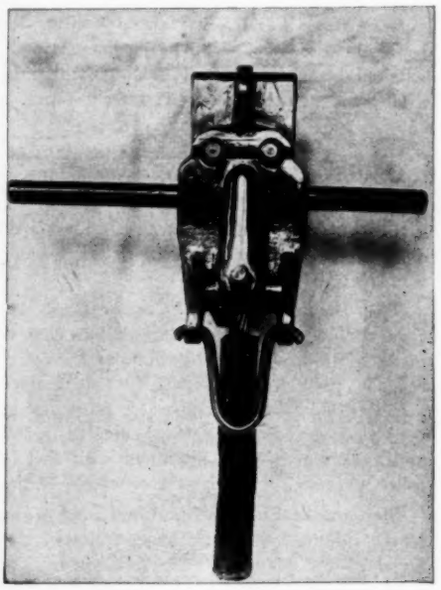


Fig. 3.—Rear View of Clamp.

Fig. 4.—Simple Switch Stick.

Fig. 5.—Safety Switch Stick.

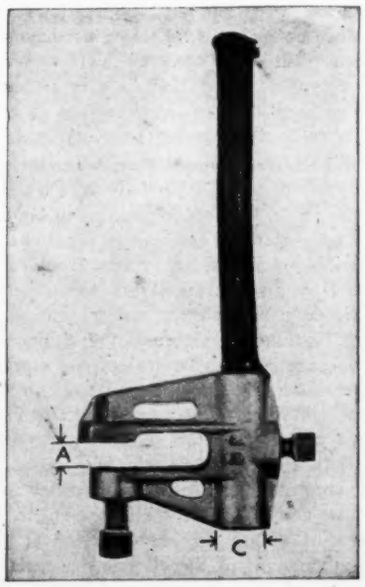


Fig. 6.—Special Ground Clamp.

INDUSTRY ACTIVITIES

Doehler Die-Casting Company, Brooklyn, N. Y., recently declared a wage dividend amounting to 10 per cent per annum to all of its employees.

Macbeth-Evans Glass Company, Pittsburgh, Pa., has issued a mailing folder illustrating its lighting equipment for stores and showing a few of the stores in which it has been installed.

Sprague Electric Works of General Electric Company, 527 West 34th Street, New York City, has issued an attractive booklet descriptive of its safety panels and dead-front switchboards.

Siggers & Siggers, patent lawyers, National Union Building, Washington, D. C., are sending out to their clients and correspondents, with the compliments of the season, a dairy for 1917.

Beardslee Chandelier Manufacturing Company, 216 South Jefferson Street, Chicago, Ill., has issued Bulletin "S-3," a supplement to its general catalog, which illustrates, describes and prices chandeliers carried in stock and on which 24-hour shipments can be made.

National Carbon Company, Cleveland, O., has issued bulletin No. 31, on brushes for automobile starting motors and lighting generators, and bulletin No. 32, on brushes for stationary motors and generators. The latter bulletin includes data on physical characteristics of brushes and other engineering information.

The Blackburn-Smith Corporation, 105 West Fortieth Street, New York City, through purchase of the filter department of James Beggs & Company, has acquired all patents, records, patterns and rights for the manufacture and sale of the Blackburn-Smith feed-water filter and grease extractor and the Blackburn-Smith sewage ejector system. The engineers and agents previously identified with these products have been taken over in a body by the new corporation.

Menominee Electric Manufacturing Company, Menominee, Mich., announces that it has purchased the property and material of the Kandem Electric Company, 29 East Twenty-first Street, New York City. For the time being the latter company will retain its name, acting, however, as a division of the home office and as New England distributor for the Menominee company, P. M. Dreyfuss being in charge of the office. The acquisition of the New York concern places the Menominee company in position to give its eastern customers better service, a feature of which will be a greatly augmented stock of its products in New York City.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has prepared nine four-page envelope enclosures for use by the trade. A folder concerning laundry irons lists irons of two weights most convenient for domestic use. An enclosure describing tailors' irons lists irons of heavier weights designed by the manufacturers for the more severe service. A folder describing electric soldering irons points to the economy, quick-heating qualities and the ability to maintain a constant or varying heat, as several of the more important advantages. Other folders descriptive of C-H products include those on electric dryers for beer vats, electric industrial stoves, circulation-type water heaters, electric plate warmers, immersion type water heaters and electric glue pots. Uniformly distributed and accurately controlled heat, which is not affected by drafts of air, and a heater without dirt, soot or ashes, and which does not vitiate the air or overheat the room are some of the advantages of the electric devices over the gas and oil appliances which they replace. Illustrations in the several folders show devices separately and also installed in service.

Universal Electric Stage Lighting Company, 240 West Fiftieth Street, New York City, has issued Bulletin F-P, on electrically illuminated fire logs and fireplaces.

Coin Manufacturing Company, 984 East Seventeenth Street, Portland, Ore., have prepared an illustrated catalog on electric melting-pots for typecasting machines.

Armstrong Cork & Insulation Company, Pittsburgh, Pa., has prepared an illustrated booklet on "Nonpareil" corkboard insulation for ice plants, cold storage warehouses, etc.

General Bakelite Company has moved its New York City office to 2 Rector Street, where it has secured commodious quarters which will facilitate the handling of its increasing business.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued a 114-page book entitled, "Handbook of Westinghouse Watthour Meters," giving descriptions, illustrations and complete technical information on the company's watthour meters.

E. D. Fuchs & Company, Chicago, Ill., announces the dissolution of the company on January 1. The concern was conducted by E. D. Fuchs and W. C. Miller. The former has become the president and treasurer of the E. D. Fuchs Electric Company, recently incorporated, and after January 1 will be located at new offices at 123 South La Salle Street, Chicago. The other officers of the new company are: O. E. Fuchs, vice-president, and S. E. Church, secretary.

The Turner Engineering Company, consulting and constructing engineer, has opened temporary offices in the Dime Savings Bank Building, Detroit, Mich. The new organization is headed by Waldso Turner, who for many years was vice-president of the Iron City Engineering Company and in active charge of both its Pittsburgh and Detroit offices. During his 13 years' association with the Iron City Engineering Company, in every capacity from wireman to manager, Mr. Turner gained experience which fully qualifies him for his new post. The new company starts under unusually fortunate circumstances. In addition to having ample financial support it already has close to a quarter of a million dollars' worth of work under contract, among which is the new plant of the Saxon Motor Car Company, work of similar magnitude for the Ireland & Matthews Company, and the Harroun Motor Company.

Wagner Electric Manufacturing Company Makes Sales Organization Changes.—Various important changes in sales office personnel and locations and in departmental heads are announced by the Wagner Electric Manufacturing Company, St. Louis, Mo., incident to its extensive expansion. They include the following: The Chicago office will remove to 918 South Michigan Avenue, where it will combine with the service station. The Boston office will remove to 88 Brookline Avenue, where it will combine with the service station. The San Francisco office will remove to 159 New Montgomery Street, where it will combine with the service station. P. B. Postelthwaite, formerly manager of the Cincinnati office, is now in charge of the service department with headquarters at the home office. J. W. Bryant, formerly in charge of the Buffalo and Syracuse offices, is now Cincinnati manager. C. P. MacGonigal, of the Philadelphia office, will be in charge of the Syracuse and Buffalo offices. The Los Angeles office will be augmented by the services of H. W. Doubrava, for many years with the New York office. The St. Louis service station is now under the direction of C. M. McCord, who was with the home office. The sales force of the home office has been augmented by the addition of E. V. Potter, E. Holstrum and O. J. Miller.

PERSONAL AND BIOGRAPHICAL

MR. H. H. HERMES recently received the appointment of new-business manager of the Ottumwa (Iowa) Railway & Light Company.

MR. WILLIAM H. PAYNE has been appointed manager of the Martinsville (Ind.) Gas & Electric Company, succeeding MR. A. C. HARRINGTON, who has resigned.

MR. H. C. PORTER, new-business manager of the St. Joseph (Mo.) Railway, Light, Heat & Power Company, was recently elected local president of the Jovians.

MR. OTIS MINARD, who has been in the employ of the Rutland (Vt.) Railway, Light & Power Company for several years, has become chief operator of the electrical plant.

MR. GUY F. HARDEN, superintendent of the Northern States Power Company, Northfield, Minn., has been elected a member of the board of directors of the Northfield Advertising Club.

MR. R. B. MARCHANT, treasurer of J. G. White & Company, Incorporated, New York City, was elected to the office of vice-president at a recent meeting of the board of directors of the company.

MR. ARTHUR T. MARTIN, formerly new-business manager for the Athol (Mass.) Gas & Electric Company, has assumed similar duties with the Marlboro-Hudson Gas & Electric Company, covering Northboro, Berlin and Bolton, Mass.

MR. M. R. GRIFFETH, of the General Electric Company, addressed a meeting of the Androscoggin Electric Company Relief Association, at Lewiston, Me., speaking on the electrification of the Chicago, Milwaukee & St. Paul Railway in Montana and Idaho.

MR. H. R. SAXON, vice-president and factory manager of the Electric Auto-Lite Company, of Toledo, O., resigned from that company recently. He will reorganize the Saxon Manufacturing Company, the original name of the Electric Auto-Lite Company, the company to manufacture auto parts and accessories in Toledo.

MR. CLARENCE O. RANDALL, formerly with the Colonial Power & Light Company, has accepted the position of electrical superintendent of the Rutland (Vt.) Railway, Light & Power Company. MR. CHARLES D. SPENCER, of Cavendish, Vt., succeeds Mr. Randall as division superintendent and system operator of the Colonial company.

MR. P. F. HODGKINS, for the past ten years connected with the Woonsocket division of the Blackstone Valley Gas & Electric Company in Rhode Island, a Stone & Webster company, has been appointed general superintendent, to succeed MR. ALFRED F. TOWNSEND, who has been transferred to Beaumont, Tex. MR. JOSEPH PRATT, in charge of the meter, arc lamp and trouble department, succeeds Mr. Hodgkins as superintendent of distribution, and MR. WILLIAM CHENEY will have charge of the meter department.

MR. M. L. HIBBARD, manager of the Union Light, Heat & Power Company, Fargo, N. D., has been appointed delegate of the Fargo Commercial Club at the annual meeting of the National Chamber of Commerce at Washington, January 31 to February 2.

MR. J. K. CHOATE, vice-president of the J. G. White Management Corporation, New York City, has just returned from a six weeks' trip to Nicaragua where he spent considerable time inspecting the property of the Ferrocarril del Pacifico de Nicaragua, which is being operated by The J. G. White Management Corporation.

MR. ARTHUR C. COBB, for three years business manager of the Worcester Suburban Electric Company, in Massachusetts, has resigned to accept the position of commercial manager of the Commonwealth Electric Company, Summit, N. J., the Lakewood (N. J.) Electric Company and the Point Pleasant (N. J.) Electric Company. The Commonwealth company's system serves 34 towns.

MR. S. B. TAYLOR, sales manager of the S K F Ball Bearing Company, of Hartford, Conn., has been appointed vice-president of the company, succeeding MR. F. B. KIRKBRIDE, who remains on the board of the company. Mr. Taylor will remain in charge of sales. MR. G. A. UNGAR, former representative of the company in Cleveland, Detroit and Pittsburgh, has been appointed technical manager and chief engineer, succeeding MR. UNO FORSBERG, who returns to Sweden, after completing his work of creating the manufacturing organization of the S K F Ball Bearing Company in this country.

MR. J. F. KILLEEN, manager of heating device sales of the General Electric Company, at the Pittsfield, Mass., plant, will assume, on January 1, the position of vice-president and sales manager of the Rathbone-Sard Electric Company, of Albany, N. Y. For nearly ten years Mr. Killeen has been active in the heating device field, particularly in the development of this branch of the General Electric Company manufacturing. He has an extensive acquaintance among electrical men, and his selection for such an important position with the Rathbone-Sard Electric Company is an endorsement of his commercial ability.

MR. B. J. GRIGSBY, who has been managing director of the Benjamin Electric, Ltd., London, E. C., England, since its incorporation in 1908, has resigned his position with that company and returned to the United States. Mr. Grigsby intends to locate a factory in Peoria, Ill., for the manufacture of porcelain enamel products including reflectors and signs for electric lighting, and in addition to specializing in porcelain enameling the new company expects to put on the market a range of electric-lighting specialties. Mr. Grigsby's temporary address, pending the completion of the new organization, will be 24 Mayer Building, Peoria, Ill.

MR. WILLIAM E. McCLINTOCK, of Morris Plains, N. J., has been appointed manager of the Newton (N. J.) Electric & Gas Company, succeeding MR. W. L. KEPLINGER, resigned. Mr. McClintock has been manager of the New Jersey Gas & Electric Company at Dover, N. J.

DR. LOUIS BELL, past president of the Illuminating Engineering Society, gave an address before the Boston Scientific Society in Smith Hall, Massachusetts Institute of Technology, December 12. The lecture was illustrated with a large neon tube owned by Dr. Bell, and a display of recent types of incandescent filament lamps and gas-filled units.

MR. WILLIAM J. HAMMER, consulting electrical engineer, of New York City, lectured before the Worcester Polytechnic Branch of the American Institute of Electrical Engineers, December 15, his subject being "The Selenium Cell and Its Scientific and Industrial Applications." Mr. Hammer illustrated his lecture with various types of the selenium cell, apparatus and charts, and by means of lantern slides showed various applications of the cell to the telegraphic transmission of pictures, telephoning over a beam of light, firing cannon and steering marine and aerial torpedoes by means of a searchlight-beam. He also showed its application to recorders of snowfall and eclipse observations, telegraphic relays and signal devices, methods of control of dynamos and motors, photometers, stethoscopes, talking moving pictures, and other devices.

OBITUARY.

MR. JAMES Y. CARITHERS, president of the Athens (Ga.) Railway & Electric Company, died December 17, at the age of 62, from heart disease. He is survived by his widow.

MR. GEORGE S. HALEY, formerly general manager of the Rutland Railway, Light & Power Company, an extensive central station and traction company in Vermont, died recently in New York City, as the result of an automobile accident.

MR. CLARKE C. FITTS, a pioneer in hydroelectric development in Vermont, died in Watertown, Mass., December 20. Mr. Fitts was a native of West Wardsboro, Vt., and was 46 years of age. He was educated in the county schools and at the Brattleboro High School, afterward engaging in teaching. He then entered a law office at Brattleboro and was admitted to the bar in 1891. He served in the Vermont Legislature and was attorney general of the state. His connection with the electrical industry began with the organization of the Connecticut River Power Company, of which he was counsel and a director. This company built a large generating station and dam at Vernon, Vt., and now operates several other hydroelectric stations, furnishing energy to many industrial enterprises and for the operation of Hoosac Tunnel in Massachusetts.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

AUBURN, ME.—George C. Webber of this city has bought the stock in the Turner Electric Light & Power Company owned by Leon Wardwell and has assumed the management of the plant. Improvements in the plant are being made, with a view to developing the business.

AUGUSTA, ME.—Hearings have been held on a joint petition of the Twin State Gas & Electric Company, of Dover, N. H., and the Berwick & Salmon Falls Electric Company for authority by which the former may lease to the latter the property and rights owned in the state of Maine for a term of 99 years; and on a petition of the latter company to issue its securities to carry out a contract for the purchase and development of a water power owned by the South Berwick Realty Corporation.

BOOTHBAY, ME.—A project is on foot to build an electric railway line from here to connect with the Lincoln & Knox County branch of the Maine Central Railroad, the cost being estimated at about $150,000. It is said that water privileges have been secured, to be used for power generation.

BRUNSWICK, ME.—The Bath & Brunswick Light & Power Company has begun the lighting of Bowdoinham and Cathance and is serving the Brunswick and Topsham water district with power for a centrifugal pump, a 100-horsepower motor being installed. The Pejepscot paper mill is also installing additional motor equipment.

PORTLAND, ME.—The Cumberland County Power & Light Company has taken over the Presumpscot Electric Company and will operate the latter as part of its system. Walter B. Bragdon will continue as manager, the territory being designated as the Westbrook branch.

SKOWHEGAN, ME.—The Central Maine Power Company, of Augusta, has taken over the distributing system at Hartland in connection with the local generating plant. It has also acquired the plant at Newport, and the sale of the controlling interest in the Skowhegan Pulp Company to the power company is reported. The latter purchase would give the purchasers 4,011 horsepower out of 5,588, the rated development on the Kennebec River at this point.

ANTRIM, N. H.—The Antrim-Bennington Electric Light Company has petitioned the State Public Service Commission for authorization to purchase the electric property of the Goodell Company of this town. A hearing was held in Concord on December 14.

DOVER, N. H.—The Twin State Gas & Electric Company of this city plans to extend its lines into the towns of Milton, Milton Mills and Union, N. H.

PORTSMOUTH, N. H.—An electric line to Portland, Me., via York Beach is proposed.

BARRE, VT.—No opposition was registered at the proposed franchise for the Central Power Corporation to establish power and transmission lines in this city when the case was heard by the City Council December 12. President C. H. Thompson in a letter stated that the company expects to have its lines in operation by July 1, 1917, but objects to filing a bond, owing to the uncertain delivery of materials. Another hearing will be held, when Mr. Thompson will be asked to appear. It is stated that the life of the franchise will probably be extended from 25 to 40 years.

BURLINGTON, VT.—The International Paper Company, New York, has purchased the water rights on the Lamoille River at Milton, formerly owned by H. O. Clark. The new owners will develop electric power and sell to industries at low rates.

LUDLOW, VT.—This community is now being served by the Colonial Power Company, a new substation having been established here. Twenty-four hour service is provided.

MIDDLEBURY, VT.—A transmission line is being constructed by the Hortonia Power Company between its station at Port Henry and a new station on Lake Dunmore. Permission has been obtained of the War Department to erect steel towers for the crossing of an arm of Lake Champlain.

ANDOVER, MASS.—A new lighting system for the main business section will be installed this winter or next spring. Iron poles or wooden poles with iron standards will be used and an ornamental effect obtained. The Laurence Gas Company provides the energy.

HAVERHILL, MASS.—The City Council is considering the proposal of the Haverhill Electric Company to replace the present arc lamps with incandescent lamps.

NEWBURYPORT, MASS.—The new turbine station of the Newburyport Gas & Electric Company has been put in operation. A 500-kilowatt machine at the old station is being transferred.

SPRINGFIELD, MASS.—Lines of the Springfield Street Railway west of the Connecticut River are being equipped with the sectional three-wire system in an attempt to eliminate electrolysis. Results are being studied by Burton McCullom, electrical engineer of the Bureau of Standards, Washington, D. C., and other experts.

NEW BRITAIN, CONN.—The Stanley Works of this city has bought the majority of stock in the Farmington River Power Company at $25 per share and will utilize its entire outfit, it is reported. A transmission line from the generating station at Poquonock to the works here is being built at a cost of about $50,000. Eight miles of poles have been set and the wires will be strung soon. The Poquonock station has a capacity of 1,200 kilowatts.

HORNELL, N. Y.—A committee of the Chamber of Commerce is considering plans for a proposed lighting system for this city. The installation of a white-way system to replace the present arc-lamp system probably will be made.

LOCKPORT, N. Y.—An aldermanic committee has made a report on the proposed establishment of a municipal electric-lighting plant here, the committee suggesting that further investigations be made.

BAYONNE, N. J.—Property owners and business interests along upper Broadway have presented a petition to the City Commission urging the immediate installation of the proposed new street-lighting system along the thoroughfare to about Fiftieth Street.

FREEHOLD, N. J.—The Monmouth Light Company has received a franchise for the operation of a local light and power system. The Board of Public Utility Commissioners has approved the measure.

MONTCLAIR, N. J.—The State Board of Education will install an underground conduit system from its power station to the State Normal School, Montclair Heights. Bids for the work will be received until January 6.

NEWTON, N. J.—Following a new local management for the Newton Electric & Gas Company, the township committee is considering the installation of an electric street-lighting system to replace the present gas lamps.

SEA BRIGHT, N. J.—Federal officials are considering a local site for the installation of a government wireless station.

TRENTON, N. J.—The Public Service Electric Company has filed a certificate showing it has issued $3,000,000 additional capital stock, the proceeds to be used for plant improvements.

CHESTER, PA.—The Consumers' Ice Company will install an engine and boiler room in the proposed addition to its ice-manufacturing plant, estimated to cost $135,000.

HAZLETON, PA.—The Harwood Electric Company has entered into agreement to install electric equipment and service for the operation of the Pond Creek coal-mining properties.

LANSDOWNE, PA.—The Public Service Commission has granted a certificate of public convenience, evidencing approval of the acquisition by the Counties Gas & Electric Company, of Philadelphia, of the outstanding stock of the Lansdowne Construction Company, a New Jersey corporation which owns securities of the Norristown Power Company and stock of the Conshohocken Power Company.

MILLERSBURG, PA.—The Upper Paxton Township Electric Light & Power Company has been chartered with a capital of $5,000 by F. Gannett and others to operate in that township.

NEW CASTLE, PA.—Charters for 15 electric companies to operate in Mercer, Lawrence and Butler Counties have been granted as follows: Jackson Township, Butler; Big Beaver Township, Lawrence; Shenango Township, Lawrence; Big Beaver Township, Beaver; Franklin Township, Beaver; Marion Township, Beaver; North Sewickley Township, Beaver; Borough of Farrell, Mercer; Borough of West Middlesex, Mercer; Borough of Wheatland, Mercer; Hickory Township, Mercer; Lackawannock Township, Mercer; Pymatuning Township, Mercer; Shenango Township, Mercer and Wilmington Township, Mercer Light & Power Companies. The capital of each will be $10,000, with offices in New Castle, the companies to operate in districts of the names taken and in the counties named.

PALO, ALTO, PA.—A contract has been awarded to the J. G. White Engineering Corporation by the Eastern Pennsylvania Light, Heat & Power Company, of Pottsville, for the engineering and construction work in connection with the following extensions and improvements to the latter company's power station at Palo Alto: Installation of 7,500-kilowatt turbogenerator and transformers of 3,000-kilowatt capacity, together with condensers, auxiliaries and necessary switching equipment; the addition of one 500-kilowatt railway rotary with transformers, and the installation of superheaters on all boilers. The addition of the above turbine to the company's power station at Palo Alto will necessitate the construction of a cooling pond to provide condenser water. The new additions to the plant will require extensive alterations and extensions to the present power plant building.

PHILADELPHIA, PA.—The Philadelphia Rapid Transit Company has filed plans for alterations and extensions to its power plant on Kensington Avenue.

PITTSBURGH, PA.—Mayor Armstrong has announced that plans are being made for improvements to the street-lighting, preliminary to entering negotiations with the Duquesne Lighting Company, whose contract for furnishing service will expire in February.

SWEDESBORO, PA.—The Council is considering a change in the present electric street-lighting system.

WILMINGTON, DEL.—The Ninth Street Association is considering plans for an ornamental lighting system in that street.

BALTIMORE, MD.—The Public Service Commission has authorized the issuance of $900,000 in bonds by the Consolidated Electric Light & Power Company of Baltimore, the proceeds to be used for improvements and extensions.

WASHINGTON, D. C.—That plans have been made by the Potomac Electric Power Company for the development of its Great Falls waterpower site, whenever it becomes apparent that this proposition is economically feasible, was stated by W. F. Ham, vice-president of the company, in the course of testimony given before the Public Utilities Commission in connection with the hearing being held on the appraisal of the company's property.

IAEGER, W. VA.—The Iaeger Water, Light, Power & Development Company has been incorporated with a capital of $25,000 by J. A. Strother and others, of Welch, W. Va., to furnish electric service in this vicinity.

LOGAN, W. VA.—The Boone Power Company has been incorporated by M. A. Maxwell and others, of Logan, with a capitalization and will supply electric service in Logan County.

DURHAM, N. C.—The power plant of

Durham Traction Company will be enlarged. An addition 35 by 100 feet will be built, brick smokestack erected, and additional machinery installed. R. L. Lindsey is general manager.

GREENVILLE, N. C.—Additional generating equipment will be installed in the municipal electric-lighting plant, of which H. L. Allen is superintendent.

CEDARTOWN, GA.—Mill No. 2 of Cedartown Cotton & Export Company will be equipped for electrical operation, power to be furnished by Georgia Railway & Power Company, of Atlanta.

PHOENIX PARK, FLA.—Plans are under way for the organization of a stock company by the citizens of Phoenix Park, Cummers Mill and Panama Park to erect an electric plant and furnish service in that section.

NORTH CENTRAL STATES.

CINCINNATI, O.—The Buckeye Hydro-electric Company has been incorporated with a capital of $25,000 by E. O. Dana, R. P. Gillham and others.

IRONTON, O.—The Ironton Electric Company has asked permission of the Public Utilities Commission for the issuance of $135,000 in capital stock, the proceeds to be used to pay off $15,000 indebtedness and the remainder to be used for the purchase of the Ohio Valley Electric Railway Company's power house and substation in Ironton.

LONDON, O.—The City Council has made a $3,000 appropriation for a street-lighting system in East First Street.

LORAIN, O.—Application for permission for the Lorain County Electric Company to take over the property and electric franchise rights of the Citizens Gas & Electric Company has been filed with the Public Utilities Commission. Improvements estimated to cost $250,000 are planned by the Lorain County Company after the merger, which probably will be approved. The improvements will include rehabilitation of the distribution system of the Citizens company and the enlargement of the Lorain County company's power plant on the lake front.

MILLERSBURG, O.—L. B. Fauver and others have incorporated the Buckeye Utilities Company with a capitalization of $50,000 to furnish electric service in this vicinity.

REPUBLIC, O.—The city has voted to issue $10,000 in bonds for the purpose of installing a municipal electric-lighting system. The money will be used to build a transmission line and the energy will be purchased from the Ohio Light & Power Company, Tiffin, O.

TOLEDO, O.—The Ohio State Telephone Company has substituted aluminum coated wire for copper wire, owing to the advanced price of the latter. It is claimed the aluminum wire clears of ice much more quickly than copper wire. The first of the new wire has been strung between Toledo and Cleveland.

SALEM, IND.—The local plant of the Interstate Public Service Company was badly damaged by fire recently. A new plant will be erected by the company.

WHEATLAND, IND.—The Wheatland Light Company has been incorporated with a capital of $2,000 by A. C. Nicholson and others to operate an electric-lighting plant.

BERWYN, ILL.—The City Council is receiving bids for the installation of a fire-alarm system.

FREEPORT, ILL.—The city has entered into a contract with the Illinois Northern Utilities Company for the electric lighting of the streets for the period beginning January 1, 1917, and extending to October 1, 1922.

PRINCETON, ILL. — Commissioner Thomas E. Wood, head of the water and light department, is advocating the installation of a new generating unit, to cost about $15,000, in the municipal electric-lighting plant.

WAUCONDA, ILL.—The Chicago, Fox Lake & Western Electric Railway Company has been given permission by the Illinois Utilities Commission for an extension of its electric railway line from Wauconda, Ill., to Antioch and to the Wisconsin state line.

EDEN, WIS.—The Wisconsin Gas & Electric Company, of Milwaukee, has purchased the holdings of the Eden Electric Light & Power Company and will take possession January 1. The former company has secured a franchise to extend the distribution system to Marblehead, where it will supply service. Local extensions are also contemplated.

EMERALD, WIS.—The Amery (Wis.) Electric Company contemplates furnishing electric service here.

MANITOWOC, WIS.—The Council will advertise for bids on the purchase of incandescent lamps for the light department for next year, at an estimated cost of $2,500.

MILWAUKEE, WIS.—The Manitowoc & Northern Traction Company has been purchased by the Wisconsin Securities Company. The deal involved the transfer of $100,000 in stocks and $118,000 worth of bonds. Additional equipment will be placed on the traction line and other improvements will be made. Clement C. Smith is president of the Wisconsin Securities Company.

NEWBURG, WIS.—H. E. Weber is planning to erect an electric-lighting plant to supply electric service here and in Fillmore, Boitonville and Saukville.

SHEBOYGAN, WIS.—The Phoenix Chair Company is considering alterations of its power plant which include the installation of 200-horsepower Corliss engine, direct-connected to a 500-kilovolt-ampere, three-phase, 60-cycle generator.

FARIBAULT, MINN.—Councilman Pomandt has circulated a petition asking the Council to call an election for the purpose of authorizing the construction of a municipal electric-lighting plant.

BURT, IOWA—The City Council will establish a municipal light and water plant.

COUNCIL BLUFFS, IOWA.—The Citizens Gas & Electric Company and a committee of the City Council have entered negotiations for a street lighting contract. It is reported that the contract will provide for an ornamental lighting system in the business district. E. A. Wickham is vice-president of the company.

DEEP RIVER, IOWA.—The City Council is considering plans for improvements to the municipal electric-lighting plant.

ELKADER, IOWA.—The Elkader Light & Power Company has been incorporated with a capital of $300,000 by F. H. Schmidt and C. G. Schmidt.

KALONA, IOWA.—The Farmers Light & Power Company has been incorporated with a capital of $10,000 by J. C. Brenneman and C. C. Yoder to furnish electric service in this vicinity.

LANESBORO, IOWA.—The local electric-lighting plant, owned by J. R. Davis, was recently destroyed by fire.

MASON CITY, IOWA.—Business men on the South Side are contemplating the installation of an ornamental lighting system.

MELBOURNE, IOWA.—The Iowa Railway & Light Company has completed negotiations for furnishing electric service here.

ST. JOSEPH, MO.—The question of issuing $852,000 improvement bonds will be considered by the Council this week. About $200,000 is proposed for improving the street-lighting system.

FORT CALHOUN, NEB.—A bond issue of $7,000, to be used for establishment of an electric-lighting plant here, has been sold.

McHENRY, N. D.—Voters here approved a bond issue for the installation of a municipal electric-lighting plant.

STEEL, N. D.—Arthur Goodwin, of Goodwin-Johnson Company, Napoleon, N. D., has purchased the local electric-lighting plant.

WARWICK, N. D.—It is reported that an electric-lighting plant will be established here next spring.

DATES AHEAD.

American Institute of Chemical Engineers. Annual convention, New York City, January 10-13, 1917. Secretary J. C. Olson, Cooper Union, New York, N. Y.

Electrical Contractors' Association of Wisconsin. Annual meeting, Hotel Wisconsin, Milwaukee, Wis., January 15-17. Secretary, Albert Petermann, 626 Lloyd Street, Milwaukee.

Western Association of Electrical Inspectors. Annual meeting, Hotel Secor, Toledo, O., January 23-25. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

American Institute of Electrical Engineers. Mid-winter convention, New York City, February 7-9. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

New Mexico Electrical Association. Annual convention, Albuquerque, N. M., February 12-14. Secretary pro tem., E. A. Thiele, Roswell, N. M.

SOUTH CENTRAL STATES.

OWENSBORO, KY.—The City Council has approved an ordinance providing for the purchase of a 1,500-horsepower Westinghouse turbine for the municipal light and power plant. The estimated cost of the addition is $40,000 installed.

PADUCAH, KY.—With a view to enlarging the municipal street-lighting plant, so that energy may be furnished for power and residential illumination, Mayor Frank M. Burns is considering estimates for improvements that would be involved.

STAMPING GROUND, KY.—W. W. Caffey is president of the Stamping Ground Promotion League, organized with the purpose of effecting ways and means by which the community can provide for an electric-lighting plant and waterworks system.

MEMPHIS, TENN.—The City Council is planning the installation of 400 new arc lamps during 1917.

MONTGOMERY, ALA.—The Montgomery Light & Water Power Company is planning the expenditure of $125,000 for improvements and extensions to be made during the early part of 1917. Contracts for the major part of the equipment have already been made, according to a statement by H. F. Frueauff, vice-president and general manager. The first work to be undertaken will be an enlargement of the capacity of the Tallasee water power plant and the erection of a substation to serve the manufacturing district in North Montgomery. Improvements to the distribution system will also be made, necessitating the installation of additional transformers, switchboard material and other apparatus.

COTTER, ARK.—The Dixie Power Company, in which W. V. Powell is interested, contemplates the installation of a hydro-electric plant on White River.

ARDMORE, OKLA.—R. M. Johnson will erect a large office building, in which will be installed an electric-lighting plant.

HOBART, OKLA.—The City Council has ordered the installation of electric lamps placed in the alleys of the business section of the city.

LAVERNE, OKLA.—The Laverne Light, Power & Ice Company has been incorporated with a capital of $30,000. E. R. Lewis is interested in the company.

LINDSAY, OKLA.—The city has voted $6,000 in bonds to purchase an engine for the electric-lighting and waterworks plants.

MOUNDS, OKLA.—The city contemplates constructing an electric-lighting plant.

MUSKOGEE, OKLA.—The Peoples Service Company has been incorporated with a capital of $5,000. A. S. Nelson is manager.

NEW WILSON, OKLA.—An election will be held January 5 on the question of issuing $30,000 sewer, light and water bonds.

RINGLING, OKLA.—The Chamber of Commerce is to consider suggestions made by the MacIntosh-Walton Engineering Company, of Oklahoma City, for installing a municipal electric-lighting plant here.

RINGLING, OKLA.—A company with a capital stock of $1,000,000 that is to establish natural gas, electric and ice plants and develop water-power sites in Southern Oklahoma was chartered this week. The incorporators are P. C. Ekern, manager of the Ardmore City Gas Company; P. C. Dings, president of the Guaranty State Bank of Ardmore, and W. D. Potter, an Ardmore attorney.

BEAUMONT, TEX.—Bids are being received this week at the custodian's office, United States postoffice and court house, for alterations and additions to the lighting and power systems.

BOWIE, TEX.—At a recent election of taxpayers it was voted that the municipality shall purchase the local electric-lighting plant. Improvements will be made to the property.

DALLAS, TEX.—The City Commission has granted the Dallas Northwestern Traction Company and the Dallas Southwestern Traction Company an extension of six months' time in which to begin the construction of their respective interurban lines. The former company plans to build an interurban from Dallas to Wichita Falls, via Denton, and the latter company from Dallas to Cleburne.

DALLAS, TEX.—It is announced that the consolidation of the Texas Traction Company and the Southern Traction Company under the name of the Texas Railways Company will take place soon. The former company operates an interurban electric line between Dallas and Denison and the latter company lines between Dallas and Waco and Dallas and Corsicana. It is planned to extend the Waco line south to San Antonio, via Austin, a distance of

about 185 miles, after the merger goes into effect.

UVALDE, TEX.—W. H. Weiss, of Kansas City, Mo., and associates have nearly finished negotiations for the purchase of the holdings of the Uvalde Electric Light & Power Company. The prospective new owners plan to make extensive improvements to the property.

WESTERN STATES.

HARLEM, MONT.—The local electric-lighting plant has been purchased by W. L. Saul, who contemplates improvements and extensions to the service.

COKEVILLE, WYO.—The construction of an electric-light and power plant on Pine Creek is under consideration.

SANTA FE, N. M.—Bids for the construction of a dam and power plant for the Rio Grande Light, Heat & Power Company will be opened in New York City early in January. The company proposes to generate current in White Rock Canyon and transmit it to Santa Fe, Albuquerque and other places.

GLOBE, ARIZ.—C. H. Munson has applied to the City Council for a franchise to enter the city with an interurban electric railway that he plans to construct between Globe and Miami.

YUMA, ARIZ.—The Blaisdell water and lighting plant has been acquired by R. M. Moore, Continental Securities Company, Los Angeles, Cal. It is said that $50,000 will be expended for extensions and improvements.

BRIGHAM, UTAH.—An election probably will be called to vote on the issuance of $10,000 in bonds for improvements to the municipal electric-lighting plant.

PRICE, UTAH.—The City Council has decided to reopen the question of purchasing energy in bulk from the Utah Power & Light Company and retail it to consumers on the present distribution system. Last spring the taxpayers voted down a proposition to sell the municipal plant to the corporation, but, since the service has not been satisfactory, it is now proposed to enter into an arrangement with the Utah company, which will necessitate the erection of a transmission line from Provo to Price.

AUSTIN, NEV.—The city has granted a franchise to Messrs. Berg & Rice for the erection of an electric-lighting plant and the necessary steps are being taken to get the plant in operation as soon as possible.

ANACORTES, WASH.—The Puget Sound Traction Light & Power Company is giving consideration to the question of extending light and power lines to this point.

INDEX, WASH.—The Town Council is considering the question of installing a municipal electric-lighting plant.

NEWPORT, WASH.—The Northern Idaho & Montana Power Company has awarded a contract to A. G. Schibsby, local contractor, for the construction of a 12-mile power line from Newport substation to Dalkena, to cost about $18,000.

OLYMPIA, WASH.—An ordinance granting a 50-year franchise to American District Steam Company, of North Tonawanda, N. Y., has been introduced in the Council and, if granted, the company will construct a light, power and heat plant.

OLYMPIA, WASH.—The Olympia Light & Power Company, of which G. H. Stevens is president, has announced that it will build a new 100-horsepower steam auxiliary power plant at Tumwater, to cost about $40,000.

PALOUSE, WASH.—A street-lighting system will soon be installed here.

SEATTLE, WASH.—Bids have been asked by the city for furnishing the city lighting department with 450,950 incandescent lamps for use during the coming year.

SEATTLE, WASH.—Plans for an extension of the electric light and power system of the city by the expenditure of not to exceed $3,000,000 have been approved by the public utilities committee of the City Council. The bill provides for the issuance of $3,000,000 in bonds and would also authorize the Board of Public Works to call for bids on a completed hydroelectric power plant. It is specified that the plant to be purchased have a continuous capacity of not less than 10,500 kilowatts and shall be capable of a total development of not less than 25,000 kilowatts. The $3,000,000 of bonds, it is provided, shall be made retireable in equal annual installments, first to be paid six years after date of issuance and final payment 20 years after that date.

BEND, ORE.—The Bend Water, Power & Light Company plans to spend $50,000 during the coming year for improvements and enlargement of its plant.

BAKERSFIELD, CAL.—A committee has been appointed by the Chamber of Commerce to prepare data for the installation of an ornamental street-lighting system. C. F. Johnson and C. W. Newberry are members of the committee.

BANNING, CAL.—The Southern Sierras power transmission line will be extended from the Imperial Valley to the Colorado River at a cost of $200,000.

CLAREMONT, CAL.—The City Trustees will install an ornamental street-lighting system on First Street.

CORONADO BEACH, CAL.—The City Trustees are planning the installation of an ornamental street-lighting system along the main boulevard.

HANFORD, CAL.—The Hanford Gas & Power Company has made application to the State Railroad Commission for permission to issue bonds for $30,000, the proceeds to be used for extensions.

IMPERIAL, CAL.—The Holton Power Company has been given the contract to light the streets of Imperial. The city will install the lamps which will be maintained by the power company.

LOS ANGELES, CAL.—The Board of Public Works has asked for bids for furnishing steel crossarms for the city.

LOS ANGELES, CAL.—The Palms lighting district has asked the Board of Supervisors for an ornamental lighting system.

LOS ANGELES, CAL.—The Board of Education has called for bids for installing electric fixtures in the library and auditorium buildings of the Lincoln high school building.

MERCED, CAL.—The City Trustees are planning to secure municipal control of the local electric lighting system. Under the plan proposed the city will become retail distributors of electrical energy, which would continue to be furnished by the San Joaquin Light & Power Corporation. City Engineer C. D. Martin is making an investigation of the plan.

OROSI, CAL.—S. J. Brubaker will install an electric plant on his ranch for the purpose of furnishing light and power.

RIALTO, CAL.—The Board of Trustees have requested the local lighting company to install additional lights in certain parts of the city.

RICHMOND, CAL.—Through a new three-year agreement with the Western States Gas & Electric Company the city of Richmond will have electroliers on Macdonald Avenue and other business streets.

SACRAMENTO, CAL.—Seventy electrically driven pumping plants have been purchased by the Sacramento Valley Colony Company.

SAN FRANCISCO, CAL.—Pierson, Roeding & Company have been awarded the contract for furnishing and delivering insulators, crossarms and pins for use on the transmission line of the Lower Cherry Power Development, Hetch Hetchy project.

SANTA, ANA, CAL.—The San Diego Consolidated Gas & Electric Company has applied to the Board of Supervisors for an electric light and power franchise in this city.

SANTA BARBARA, CAL.—The City Council has decided to install concrete standards and an ornamental lighting system on lower State Street between Dela Guerra Street and the Boulevard.

SANTA BARBARA, CAL.—According to Robert McKenzie, city electrician, nearly every building in the fire district is wired with knob and tube work which will have to be removed after the first of the year to conform with the new city ordinance which goes into effect at that time.

TULARE, CAL.—The Mount Whitney Power & Electric Company has been awarded a contract for the installation of an ornamental street-lighting system, comprising 64 standards

VALLEJO, CAL.—Officials of the Mare Island navy yards have been notified that the Bureau of Yards and Docks had asked for $600,000 in the next navy appropriation bill for improvements in this yard. The bureau's program, it was announced, included an extension of the central power station at a cost of $100,000.

Financial Notes

Directors of the Pacific Gas & Electric Company met on December 29 to declare a dividend of $1.25 per share on the common stock, payable January 15 to stock of record December 30.

The Maine Public Utilities Commission has granted authority to the Kittery Electric Light Company to declare a stock dividend. Recently it leased its property and franchise to the Rockingham County Light & Power Company, Portsmouth, N. H., for a term of 99 years, the rental being a semi-annual dividend of 3.5 per cent on the par value of all stock outstanding, aggregating $20,000, and on additional stock to the amount of $5,000 to be issued under authorization of the commission as distribution of undivided profits.

A notable increase in the earnings of all subsidiary companies of America Power & Light Company is shown in the report just issued for the month of November, 1916, and for the 12 months' period ended November 30. Gross earnings of the subsidiaries for the month, inter-company charges eliminated, amounted to $782,940, as compared to $694,900 for November of the preceding year, an increase of $88,039, or 13 per cent. This was also an increase over the preceding month of October of $56,213. Net earnings for the month amounted to $374,668, as compared to $332,293 for the corresponding month of 1915, an increase of $42,375, or 13 per cent. This amount also represented an increase of $26,625 over the net earnings of the preceding month. Gross earnings of the subsidiary companies for the 12 months ended November 30, 1916, amounted to $8,416,623, as compared to $7,792,298 for the corresponding period of the preceding year, a gain of $624,325, or of 8 per cent. This was an increase of $94,440 over the 12 months' period ended October 30, 1916. For the 12 months' period ended November 30, 1916, net earnings of the companies were $3,931,216, as compared to $3,552,554, a gain of $378,662, or of 11 per cent. This amount also represented an increase of $40,766 over the net earnings of the 12 months' period ended October 30, 1916.

All monthly records of Cities Service Company were broken by the November revenues. For this period the gross income was $1,328,389, a gain of $937,766, or 170 per cent over November, 1915, and more than $200,000 in excess of the figures for October, the previous record month. For the first time in the history of the company the monthly balance available for dividends on the common stock crossed the million dollar mark, being $1,033,756, and larger by $730,336, or 240 per cent, than in November, 1915. For the 12 months ended November 30, the gross earnings were $9,071,719, an increase of $4,719,306, or 108 per cent, as compared with the 12 months ended November 30, 1915. The balance for the common stock was $6,272,488, a gain of $4,147,183, or 200 per cent over the previous period. The constant widening of the margin of earnings over preferred dividend requirements is evidenced in the 12 months' state-

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 18.	Dec. 25.
American Telephone & Telegraph (New York)	125⅞	125⅛
Commonwealth Edison (Chicago)	141	140⅝
Edison Electric Illuminating (Boston)	220	225
Electric Storage Battery, common (Philadelphia)	69	69
Electric Storage Battery, preferred (Philadelphia)	69	69
General Electric (New York)	172½	167¾
Kings County Electric (New York)	125	125
Massachusetts Electric, common (Boston)	4¼	4½
Massachusetts Electric, preferred stamped (Boston)	28	27
National Carbon, common (Chicago)	.....	330
National Carbon, preferred (Chicago)	.....	.....
New England Telephone (Boston)	124½	121
Philadelphia Electric (Philadelphia)	31¾	33
Postal Telegraph-Cables, common (New York)	.....	65
Postal Telegraph-Cables, preferred (New York)	65	.....
Western Union (New York)	101¾	101½
Westinghouse, common (New York)	55¼	56
Westinghouse, preferred (New York)	.....	.....

ment, when the dividend on the senior issue was earned 3.77 times compared with 3.61 times for the 12 months ended October 31, 1916, and 2.35 times for the 12 months ended November 30, 1915. For the 12 months' period 33.08 per cent was earned on the common stock, as compared with 30.25 per cent for the 12 months ended October 31, 1916, and 14.44 for the 12 months ended November 30, 1915. The earnings for the single month of November were at the annual rate of nearly 55 per cent on the amount of common stock outstanding on November 30, 1916. The electric light and power subsidiaries in general, and particularly those operating the state of Ohio, are reporting large and growing gains in business, the result of which was the recent placing of a record order for generating equipment with the General Electric Company.

Reports of Earnings.

DAYTON POWER & LIGHT

	1916.	1915.
November gross	$159,344	$111,094
Operating expenses	123,463	55,747
Net earnings	35,881	55,347
Non-operating revenue	690	1,281
Total income	36,571	56,628
Interest on bonds	15,204	15,268
Other interest and sinking fund	4,762	3,319
Total deductions	19,966	18,607
Net income	16,605	38,021
Dividend on preferred stock	14,813	11,332
Surplus	1,792	26,689

PENN CENTRAL LIGHT & POWER

	1916.	1915.
October gross	$104,756	$77,535
Operation	66,874	41,106
Gross less operation	37,882	36,428
Taxes	2,265	3,216
Net	34,617	33,211
Fixed charges	23,794	21,534
Net to dividends and surplus	10,823	11,677

New Incorporations

PITTSBURGH, PA. — Armstrong & White. Capital, $20,000. Electrical supplies. B. B. White, treasurer.

CANTON, O.—Canton Electric Company has increased its capital stock from $2,500,000 to $12,500,000.

COLUMBUS, O.—Ohio River Power Company. Capital, $10,000. Incorporators: H. M. Daugherty and others.

CHICAGO, ILL.—Electric Manufacturing Company has increased its capital stock from $700,000 to $1,000,000.

NEW FREEDOM, PA.—American Insulator Company. Capital, $150,000. Incorporators: H. C. Kugler and others.

LYNN, MASS.—Electrical Welder Company. Capital, $850,000. Incorporators: C. L. Felton, E. T. Connolly and D. J. Lyne.

JAMESVILLE, N. Y.—Best Electric Wire Company. Capital, $250,000. Incorporators: A. A. Reed, G. A. Cowles and E. C. Spencer, all of Syracuse, N. Y.

NEWARK, N. J.—Jewel Lamp Company, Capital, $125,000. Manufacture lamps. Incorporators: J. J. Steinharter, J. Hollander and S. E. Hollander.

ROCHESTER, N. Y.—Aurora Battery Corporation. Capital. $25,000. Incorporators: E. Linck and L. A. Brahler, of Rochester, and H. H. Servis, of Buffalo, N. Y.

CLEVELAND, O.—Rex Light Material Manufacturing Company. Capital, $50,000. Manufacture electrical appliances. Incorporators: W. H. Rigsby, George Gardinea and others.

ANNISTON, ALA.—Anniston Plumbing & Electric Company. Capital. $10,000. Incorporators: G. H. Cress and E. M. Martin, of Anniston, and A. L. Kenyon, of Columbia, S. C.

CANAJOHARIE, N. Y.—Canajoharie Supply Company. Capital, $10,000. Electrical contracting and deal in electrical goods. Incorporators: B. Arkell, W. H. Lipe and W. J. Roser.

ST. LOUIS, MO.—Del-Home Light Company. Capital. $15,000. General lighting, power and power apparatus business. Incorporators. W. O. Waldsmith, F. W. A. Vesper and A. H. Mikesell.

ST. LOUIS, MO.—Fore Electrical Manufacturing Company. Capital, $10,000. Manufacture electrical tools and devices. Incorporators: J. H. McEwen, Albert Wehmeier and L. R. Brown.

INDIANAPOLIS, IND.—Standard Electric Manufacturing Company. Capital, $100,000. Manufacture and deal in electrical appliances. Incorporators: D. A. Frew, E. C. Applegate and B. F. Hall.

DOVER, DEL.—The International Electric & Signal Company. Capital, $1,500,000. To manufacture electric and pneumatic systems of signaling: Incorporators: Samuel B. Howard, Joseph F. Curtin and Arthur W. Britton, New York City.

JERSEY CITY, N. J.—The Campbell Lamp Company. Capital, $100.000. To manufacture electric and gas fixtures, lamps, globes, etc. Incorporators: Charles A. Campbell and Henry W. Van Allen, Brooklyn, N. Y., and E. C. Abell, New York.

Proposals

ELECTRIC WIRING.—Sealed bids will be received until January 5, by the Board of Directors of the Municipal Tuberculosis Sanitarium of Chicago, Ill., Room 1514, 105 West Monroe Street, for electric wiring involved in power house and laundry extensions and alterations. Specifications may be obtained at the office of Jarvis Hunt, Architect, 1508 Michigan Boulevard Building.

MOTOR-GENERATOR SETS. — Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until January 2, for furnishing two 300-kilowatt motor-generator sets and switchboard at the navy yard, Norfolk, Va. Specifications may be had on application to the Bureau of Yards and Docks, or to the commandant of the navy yard named.

ELECTRIC-LIGHTING SYSTEM.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until January 22, 1917, for an electric light and power system for the structural shop at the navy yard, Norfolk, Va. Plans and specifications may be obtained on application to the Bureau of Yards and Docks, Washington, D. C., or to the commandant of the navy yard named.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 547, Boston, Mass., two turbogenerating sets, miscellaneous watertight annunciators, ammeters, voltmeters, and electrical supplies. Schedule 554, Philadelphia, Pa., three ventilating sets, including motors and controllers. Bidders desiring to submit proposals should make application to the Bureau or to the nearest navy yard purchasing office.

Electrical Patents Issued December 19, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,208,730. **Motor-Generator Set.** C. J. Best, Delphos, O. Arrangement of series and shunt field windings of direct-current apparatus.

1,208,743. **Incandescent Electric Lamp.** W. J. Cameron, Chicago, Ill. Has heat-insulating casing with lens in end surrounding lamp, and attaching plug.

1,208,746. **Reversing Mechanism for Electrically Operated Washing Machines.** J. W. Cavanagh, assignor to M. E. Gugel, Oakhurst, N. J. Gearing details.

1,208,750. **Lamp-Glove Fixture.** E. Cochran, Cleveland, O. Clip for shade hangers.

1,208,752. **Block-Signaling System for Railways.** A. V. T. Day, assignor to Hall Switch & Signal Co., New York, N. Y. Signals operated by changes in polarity.

1,208,756. **Electric Heating-Unit.** A. Khotinsky, assignor to Central Scientific Co., Chicago, Ill. Mounting of unit comprising resistor wound on insulating tube.

1,208,759. **Reflector.** H. D'Olier, assignor to H. Hubbell, Bridgeport, Conn. Two-part structure.

1,208,775. **Electric Circuit-Controller or Switch.** J. Hamilton, Boston, Mass. Structure of device having switch arms on a controllable, motor-operated, revoluble shaft.

1,208,780. **Car-Signaling System.** W. H. Heulings, assignor to J. G. Brill Co., Philadelphia, Pa. Details of push-button structure for mounting in car walls for signaling stops to motorman by passenger.

1,208,796. **Signal Device for Street Cars.** G. B. Kohler, assignor to J. G. Brill Co. Modification of above.

1,208,808. **Method of Making Wall Coverings.** J. W. McInode and A. E. Whitney, Winchester, Mass. Electroplate for impression cylinder is formed from wood with gum removed and a conductor deposited thereon.

1,208,817. **Electric Furnace.** J. W. Moffat, Toronto, Can. Has a stationary stack and a unit comprising a crucible and a reduction chamber tiltable to close off the stack.

1,208,822. **Locking Means for Internal-Combustion Motors.** C. W. Obert, Brooklyn, N. Y. Manner of securing timing element of ignition system to shaft.

1,208,830. **Appliance for Purification of Liquids.** A. Pratt, New York, N. Y. Supply to sterilizing lamps regulated by photosensitive cell receiving light through liquid treated.

1,208,842. **Clutch.** C. F. Schnuck, assignor to Farrel Foundry & Machine Co., Ansonia, Conn. Electromagnetically controlled coil-clutch.

1,208,845. **Lamp-Light Deflector and Mechanism for Operating the Same.** T. Shaffer, St. Joseph, Mo. For headlights.

1,208,863. **Stop Motion.** A. F. Waldow, assignor to Whitin Machine Works, Whitinsville, Mass. Electromagnetically controlled device for throwing of power arranged to be least affected by jars and vibration.

1,208,866. **Electric Switch.** F. F. Weishaar, Cleveland, and F. W. Jackson, Elyria, O. For controlling automobile direction-indicator.

1,208,870. **Combined Light and Illuminated Sign.** E. E. Whitlock, Cleveland, O. For attachment to ceiling.

1,208,874. **Insulator.** W. E. Wilson, Lookout, W. Va. For line wires; has wireless tie.

1,208,880. **Magnetic Separator.** P. Wright and G. Land, Seattle, Wash. Of type having rotating cylinder with included subjects.

1,208,884. **Conductor for Systems of Electrical Distribution.** C. W. Abbott, assignor to American Conduit Mfg. Co., Pittsburgh, Pa. Ribbon conductor and cover form casing for enclosed insulated conductor.

1,208,914. **Lamp Reflector.** J. B. Clary, assignor to G. C. Prentice, San Diego, Cal. For headlights.

1,208,926. **Ignition Device.** B. Dick and V. A. Flynn, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Sparking is controlled by fuel pressure in ignition chamber of engine.

1,208,929. **Coupling Device for Vehicles.** E. P. Doyle, assignor to W. T. Van Dorn, Chicago, Ill. Electric coupler between cars automatically connected following mechanical coupling.

1,208,938. **Automobile Signal.** E. D. Finch, Atlanta, N. Y. Structure of cable connecting with lamp.

1,208,959. **Storage-Battery of Housing.** E. A. Hawthorne, Bridgeport, Conn. Casing with special venting structure.

1,208,961. **Circuit-Controlling Device.** J. O. Heinze, assignor to J. O. Heinze Co., Springfield, O. For ignition, lighting, etc., of circuits of motor vehicles.

1,208,962. **Starting and Lighting System.** J. O. Heinze, assignor to J. O. Heinze Co. Arrangement of starting motor and generator.

1,208,981. **Dynamoelectric Machine.** A. Kimble, assignor to W. N. McEwen, Chicago, Ill. Compensated series motor.

1,209,003. **Ignition Dynamo.** C. T. Mason, assignor to Splitdorf Electrical Co., Newark, N. J. Details of magnet-electric generator.

1,209,014. **Current Connection for Electric Lamps.** J. A. Orange, assignor to General Electric Co., Schenectady, N. Y. Plug and socket.

1,209,024. Current Meter. H. E. Popp, Cleveland, O. For measuring velocity of water stream; current acts on plunger to vary electric resistance.

1,209,059. Signal Device for Automobile Drivers. T. M. Smith, Baltimore, Md. Lamp is mounted on driver's arm.

1,209,064. Lighting Fixture. M. P. Stevens, assignor to E. J. Schroeder and C. A. Schroeder, Jersey City, N. J. For ceiling attachment.

1,209,073. Fuel Heater for Internal-Combustion Engines. E. S. Tesdell, Des Moines, Iowa. Fuel chamber heated by resistors.

1,209,086. Alternating-Current Motor. H. Weichsel, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Has variable number of stator poles and commuted rotor winding.

1,209,096. Conductor. R. B. Williamson, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Composite conductor for dynamoelectric machines.

1,209,122. Warping Apparatus. H. D. Colman, assignor to himself, L. Miller and H. A. Severson, Rockford, Ill. Has electrically controlled stop-motion.

1,209,132. Machine for Subjecting Air to Violet and Ultra-Violet Rays. N. W. Davis, assignor of one-half to E. M. Markel, Des Moines, Iowa. Apparatus for subjecting air to brush discharge.

1,209,146. Selective Means for Switches. G. B. Gray, Pittsburgh, Pa. Switch is moved in opposite directions by unidirectional motor.

1,209,148. Diaphragmatic Sound Producer. L. Gribman, assignor to Electric Spark Appliance Co., New York, N. Y. Motor-operated horn.

1,209,152. Lamp Attachment for Dry Cells. W. A. Harvey, Scranton, Pa. Flashlight.

1,209,155. Beam Deflector for Searchlamps. E. F. Heard, Newport News, Va. Lamp in headlight is moved by steering gear of automobiles.

1,209,167. Socket Shell-Cap and Insulating Lining Therefor. J. Keefe, assignor to Zee Socket Mfg. Co., Boston, Mass. Lining is frictionally held in cap.

1,209,214. Magnet Rail for Electrical Musical Instruments. M. L. Severy and G. B. Sinclair, assignors to Choralcelo Co., Boston, Mass. Permits adjustment of magnets operating sonorous bodies.

1,209,231. Alarm Controller. J. B. Tibbs, Indianapolis, Ind. Details of electromagnetic signal-operating apparatus.

1,209,234. Thermostatic Controller for Electrically Heated Devices. C. Truitt, Pomona, Cal. Details of contact device.

1,209,235. Adjustable Electric-Light Shade and Reflector. R. F. Vass, Wilmington, N. C. For attachment to socket.

1,209,247. Process for Manufacturing Electric Incandescence Bodies. C. O. Bastian, London, England. Convolutions of metal spiral are separated by coating on wire which is removed before sealing off.

1,209,253. Impulse-Transmitting Device. J. G. Blessing, assignor to Automatic Electric Co., Chicago, Ill. For automatic telephone system.

1,209,254. Telephone Stand. J. W. F. Blizard, assignor to Keystone Telephone Co., Philadelphia, Pa. Supporting table for instrument and seat for user.

1,209,266. Repeating Coil. H. D. Currie, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Transformer construction; for telephone circuit.

1,209,267. Electric Blasting-Machine. E. W. Davis, assignor to Aetna Powder Co., Chicago, Ill. Apparatus for producing a prolonged discharge for igniting charge.

1,209,269. Magnetic Separator. M. Dings and R. A. Manegold, assignors to Dings Electromagnetic Separator Co., Milwaukee, Wis. Material is fed between poles of magnet and rotating disk of magnetic material.

1,209,270. Vehicle Signal. S. G. Douglass, assignor to Vehicle Signal Co. Direction-indicator for automobiles.

1,209,273. Time-Controlled Electric Switch. C. Fayer, assignor to Wappler Electric Co., New York, N. Y. Timed by pneumatic retarding means.

1,209,279. Telephone Transmission System. W. A. Fricke, assignor to Automatic Electric Co., Chicago, Ill. Arrangement of transmitter and receiver bridged across line.

1,209,281. Electrical Vibratory Contact-Maker and Breaker. J. Gardner, assignor to J. P. O'Donnell, London, England. Mounting of electromagnetically operated device.

1,209,291. Telephone Apparatus. K. B. Hastings, assignor to Globe Ear-Phone Co., Boston, Mass. Apparatus for aiding defective hearing.

1,209,293. Automatic Telephone System. H. E. Hershey and G. A. Yaonchowski, assignors to Automatic Electric Co., Chicago, Ill. Has special busy test.

1,209,298. Dry Cell. W. Hoppie, assignor to W. J. Latchford, Los Angeles, Cal. Relates to electrode coating.

1,209,303. Multiple-Dial Calling Device. A. E. Keith, assignor to Automatic Electric Co., Chicago, Ill. For automatic telephone systems.

1,209,304. Impulse-Transmitting Device. A. E. Keith, assignor to Automatic Electric Co. Calling means for automatic telephone systems.

1,209,307. Driving Mechanism for Phonographs. F. Kraft, Highwood Park, N. J. Comprises spring and electric motors, the latter being cutout when former is operating.

1,209,310. Electric Current-Supplying Mechanism. N. D. Levin, assignor to Jeffrey Mfg. Co., Columbus, O. Cable reel apparatus for supplying current to moving vehicle.

1,209,313. Signal Mechanism and the Like. H. S. Lycoe, Pittsburgh, Pa. Battery flashlamp with adjustable signal disk.

1,209,324. Electron Emitting Cathodes and the Process of Manufacturing the Same. A. M. Nicolson and E. C. Hull, assignors to Western Electric Co., New York, N. Y. Conductor is coated with hydroxid of strontium, a coat of barium resinate is then applied and then subjected to high temperature.

1,209,332. Signaling Device for Writing or Copying Telegraphs. A. Rappenecker, assignor to Telepantofraph-Gesellshaft mit beschrankter Haftung, Bremen, Germany. Receiver has a spot of light following the transmitting pencil.

1,209,352. Speed Selector. J. H. Stortz, Philadelphia, Pa. Electromagnetically operated speed-changing gearing.

1,209,372. Electrical Measuring Apparatus. F. Wunsch, assignor to Leeds & Northrup Co., Philadelphia, Pa. Comprises a thermocouple with a potentiometer as reading instrument.

1,209,397. Transmitting Apparatus. J. L. Comer, assignor to Automatic Enunciator Co., Chicago, Ill. Electrical repeater comprising combination of Wheatstone bridge circuits.

1,209,403. Electric Horn. W. W. Dean, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. Has diaphragm operated by electromagnet.

1,209,407. Test System. A. G. Donahoe, assignor to Associated Engineers Co., Chicago, Ill. For remotely controlled switch mechanism.

1,209,443. Alternating-Current Motor. H. W. Jeannin, Warren, O. Details of commutator short-circuiting means.

1,209,445. Service Switch and Fuse Mechanism. J. A. Jessen, assignor to Palmer Electric Mfg. Co., Boston, Mass. Has an opening in cover of box which is closed when fuse and switch are in active position.

1,209,449. Electric Rivet-Heater. W. S. Johnson and J. W. Sheffer, assignors to American Car & Foundry Co., St. Louis, Mo. Relates to details of transformer structure and connections.

1,209,468. System of Controlling Railway Cars. W. S. Menden, assignor to Megosin Co., New York, N. Y. Is adapted to prevent excessive or unduly reduced speeds.

1,209,469. System of Controlling Railway Cars. W. S. Menden, assignor to Megosin Co. Comprises special emergency stop.

1,209,478. Automatic Ringing Mechanism for Telephone Systems. C. E. Myers, assignor of one-half to G. D. Ash, Lansing, Mich. Details of vibrator and relay circuits.

1,209,517 and 1,209,518. Electric Regulator. L. W. Thompson, assignor to General Electric Co., Schenectady, N. Y. Vibratory contact regulators for alternating-current dynamos and circuits.

1,209,526. Current Connection for Electric Lamps. F. H. Weston, assignor to General Electric Co., Schenectady, N. Y. Socket and plug.

1,209,533. Metal Conduit for Electric Wires. C. W. Abbott, assignor to American Conduit Mfg. Co., Pittsburgh, Pa. Comprises a flat base section and an overlapping U-shaped section.

1,209,540. Electric Arc Lamp. H. Beck, assignor to General Electric Co., Schenectady, N. Y. Method of checking and effacing the side burning of the anode of an arc lamp.

1,209,553. Combined Oil Cup and Circuit-Closer. J. E. Campbell, Greenville, Miss. Has a thermostatic circuit-closer for an alarm circuit.

1,209,563. Apparatus for Strengthening the Sparks of Ignition for Internal-Combustion Engines. L. Daucher, Suresnes, France. Arrangement of condensers and spark gaps.

1,209,568. Resistance Unit. G. H. Dorreloh and E. Pons, assignors to General Electric Co., Schenectady, N. Y. Mounting for helically wound resistor.

1,209,581. Trolley System. C. J. Hixon, assignor to General Electric Co. Catenary suspension system.

1,209,598. Selective Signaling System. R. C. Leake, assignor to General Railway Signaling Co., Gates, N. Y. Comprises a code impulse transmitter and a telephone receiver.

1,209,600. Headlamp. L. D. Long, Bronson, Kans. Structure of casing.

1,209,604. Connector for Electric Conductors. H. F. Maxim, Norfolk, Va. Clamp formed of single, integral piece of wire.

1,209,626. Current Connection for Electric Lamps. H. R. Sargent, assignor to General Electric Co. High-current receptacle.

1,209,628. Process of Manufacturing Iron From the Scraped of Zinced Sheet-Iron. O. Schliemer, assignor to Dr. Kurt Albert Chemische Fabrik, Neuss, Germany. Carried out in electric furnace.

1,209,629. Automobile Vibrating Horn. S. Scognamillo, N. Y. Diaphragm is vibrated by electromagnet.

1,209,636. Sound-Operated Circuit-Controller. C. Berger, assignor to Submarine Wireless Co., New York, N. Y. Details of sound-operated contact device for submarine signaling.

1,209,637. Door Lock and Door Switch for Electric Elevators. R. Brenne, assignor to Kaestner & Hecht Co., Chicago, Ill. Electrically interlocked with hoisting drum and controller.

1,209,646. Electromagnet. W. C. Reed, assignor to Telectric Co., Pittsfield, Pa. Structural details of core, plunger, etc.

PATENTS EXPIRED.

The following United States electrical patents expired on December 26, 1916:

639,713. Elevated Electric-Car Line. J. H. Cooley, Abilene, Tex.

639,716. Telautograph. F. W. Cushing, Highland Park, Ill.

639,725. Electric Heater. E. E. Gold, New York, N. Y.

639,767. Chemical Electric Excitant. J. Post, New York, N. Y.

639,768. Telephone Attachment. D. Queen, Janelew, W. Va.

639,786. Electric Arc Lamp. P. H. F. Spier, New York, N.Y.

639,792. Repair Tool for Use by Electric Line men. J. H. Sullivan, Grand Rapids, Mich.

639,811. Electro-Depositing Anode. H. L. Hass, New York, N. Y.

639,824. Electric-Light Appliance for Controlling the Number of Incandescent Lights to be Burned on a Circuit. A. Peters, Manitou, Colo.

639,826. Telephone Attachment. H. J. Richardson, Albion, Mich.

639,830. Telephone Instrument. J. J. Schoenleber, St. Paul, Minn.

639,849. Portable Hand Dynamo. S. Evershed, London, England.

639,880 Trolley. B. F. Adair, Wilmington, Del.

639,905. Electric Battery. J. Post, New York, N. Y.

639,932. Trolley. Eduard Penning-Dupuis, Halle-on-the-Saale, Germany.

639,948. Junction Box or Other Coupling for Casings for Electric Cables or Wires. A. Sundh, Yonkers, N. Y.

639,957. Regulator for Dynamoelectric Machines. R. E. Ball, New York, N. Y.

640,001. Electric Fuse. I. Kitsee, Philadelphia, Pa.

640,006. Storage Battery. C. Lindenberger, H. Lindenberger and W. B. Teal, Hannibal, Mo.

640,009. Trolley Wheel. G. E. Mittinger, Jr., Cleveland, O.

640,050. Suspension Railway and Car or Carriage Therefor. C. von Thal, St. Petersburg, Russia, and R. Weiss, Surenes, France.

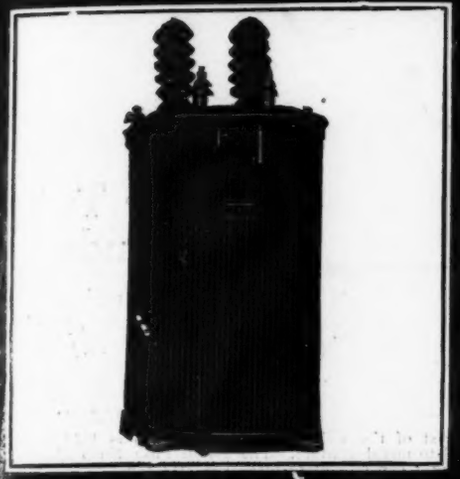
640,056. Electric Hair Brush. W. J. Werntz, Annapolis, Md.

640,062. Automatic Circuit-Breaker. E. F. Winfield, San Francisco, Cal.

640,140. Electrically Illuminated Sign. J. E. Lloyd, Cleveland, O.

640,143. Electric Heater. R. Lundell, New York, N. Y.

640,146. Electric Railway. G. W. McClintock, Wollaston, Mass.



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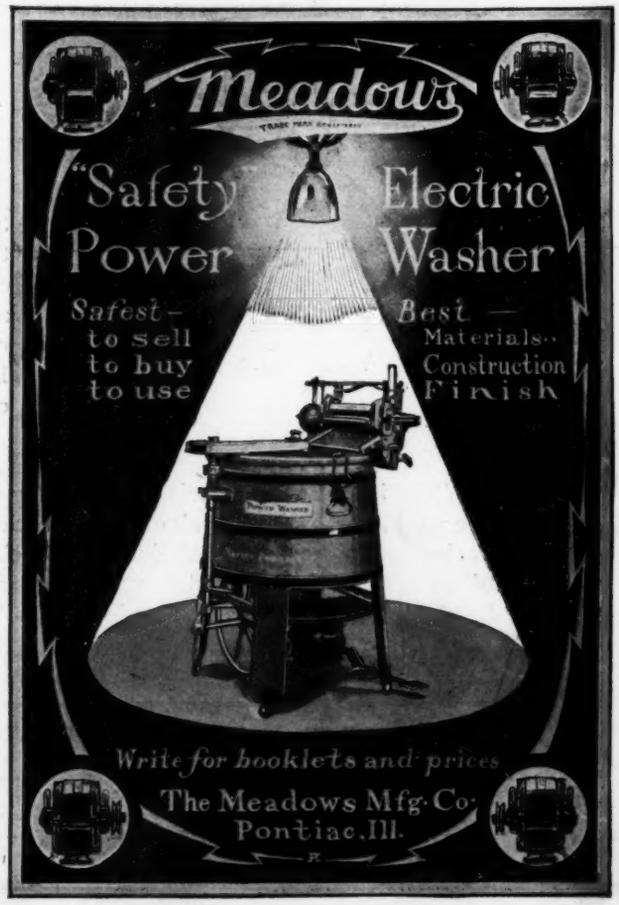

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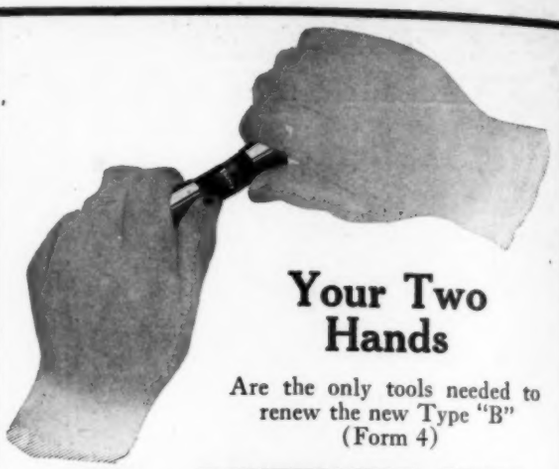

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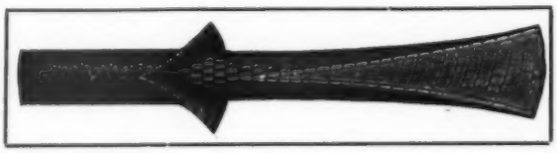

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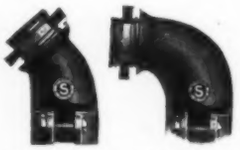

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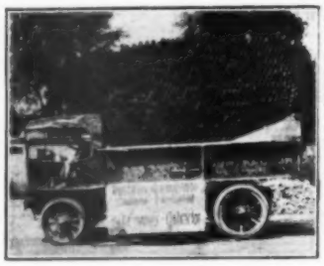

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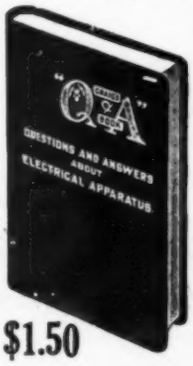

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Eliminate tampering, theft of current and interference with your service. Standardize service installations and protect your customers by using Metropolitan Protective Devices.

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35 Vestry Street - - - New York City
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90 Sherbourne Street - - - - Toronto - Canada

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INSULATED WIRES AND CABLES
HAZARD MFG CO
WILKES-BARRE PA
NEW YORK 533 CANAL STREET
PITTSBURGH 1st NAT'L BANK
CHICAGO 552 W ADAMS ST

Electrical Exchange

Anything to sell?
Do you want help?
Do you require a position?

Make your wants (Electrical) known in the classified columns of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. See page 46 of this issue.

FIELD COILS SOLENOIDS ELECTRO MAGNETS MAGNET WIRE

THE ACME WIRE COMPANY

NEW HAVEN
CONNECTICUT

The Highest Attainment of Insulation Permanence

AWARDED GRAND PRIZE

Made by

American Steel & Wire Company

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Export Representative: U. S. Steel Products Co., New York

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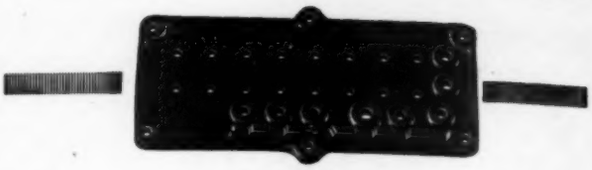

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MOLDED PARTS

For Electrical and Commercial Use

Bakelite and Other Compounds

Belden Manufacturing Co.

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ROEBLING

Wires and Cables

include bare iron, steel and copper wire, annunciator wire, office wire, lamp cord, heater cord, weatherproof wire, rubber covered wire, lead encased telephone and power cables and all other wires and cables used for electrical purposes. Wires are drawn from carefully selected metals and insulated with the best materials, applied in a manner that assures long and satisfactory service.

John A. Roebling's Sons Company

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MAGNET WIRE

MOORE MAGNET WIRE IS THE STANDARD OF EXCELLENCE

ALFRED F. MOORE

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CHATTANOOGA NEW ORLEANS

Show Window Cord Lamp Cord

LOWELL INSULATED WIRE CO.

Lowell, Mass.

N. E. C. S. Wire Telephone Wire

...The...

National Conduit and Cable Co.

EXECUTIVE OFFICES

41 Park Row - - - New York, N. Y.

Manufacturers of

Bare Copper Wire and Cable

Weatherproof Wires and Cables

Paper Insulated Cables

For Power, Telephone and Telegraph

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JOHN G. ALDRICH, Pres. J. F. BLAUVELT, Agt. RUSSELL W. KNIGHT, Treas.

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MANUFACTURERS OF

Machinery for Insulating Electrical Wires

Braiding, Taping, Winding, Twining, Cabling, Stranding, Polishing and Measuring Machines

CABLE COVERING BRAIDERS FINE CASTINGS A SPECIALTY

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DOLPHIN

INSULATED WIRE

Notable for its uniformly high quality and dependability.

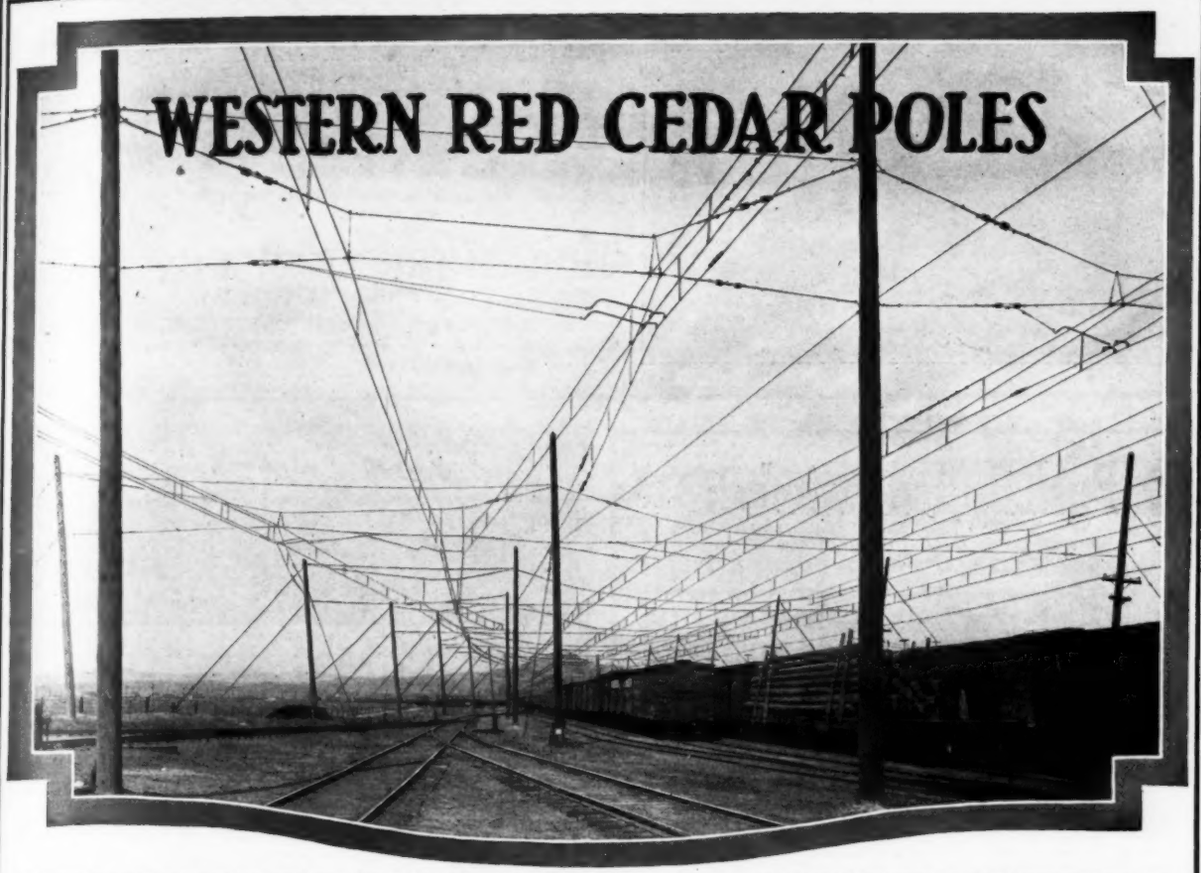
DOLPHIN ATLANTIC

Atlantic Insulated Wire and Cable Company

Sales Office: 120 Liberty Street, New York

Factory—Stamford, Conn.

Commercial Code



Overhead construction in the Butte (Mont.) yards of the Chicago, Milwaukee & St. Paul Railway; 3000 volt direct-current electrification, supported by Western Red Cedar Poles.

There are three facts about the electrification of the mountain divisions of the **Chicago, Milwaukee & St. Paul Railway** well worth keeping in mind.

1. This tremendous electrification of a trunk line stands out as one of the greatest pieces of work ever done in the electrical industry.

2. It established a notable record in thorough and efficient construction at low cost.

3. In this great piece of construction built for hard service for many years to come the engineers wisely used

Western Red Cedar Poles

They Carry the Heavy Load. They Stand the Strain. The Most Beautiful of All Poles

Western Red Cedar Association

Peyton Building, Spokane, Washington

More Current Needed

The rapidly increasing use of storage battery industrial trucks and tractors is bound to bring a big demand for current for charging batteries.

Central Stations will find it profitable to help in developing this new field of business.

Let us send you our literature on the "Ironclad-Exide" battery which is the standard battery for this service.

THE ELECTRIC STORAGE BATTERY CO.
PHILADELPHIA, PA.

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Push Button Switches

The "Fewpart" Cat. No. 223

"Fewpart"

Action exceptionally easy—stands up under tests with the best on the market

TRUMBULL ELECTRIC MFG. CO. Plainville, Conn.

Electrical Slate

IMPERIAL BLACK MONSON BLACK
PENRHYN PURPLE
Send for Electrical Price List No. 5

DAVIS SLATE & MANUFACTURING CO.
CHICAGO, ILL. BANGOR, PA.

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PLATINUM

Wire, Sheet, Rivets and Contacts
All of Baker Standard Quality
Scrap purchased or exchanged

BAKER & CO., INC.
NEW YORK OFFICE, 30 Church St. Murray and Austin Sts., NEWARK, N. J.

Service Switches

and **Meter Test Blocks** that prevent theft of current

The Palmer Electric & Mfg. Co.
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THE BRADY ELECTRIC MFG. CO., NEW BRITAIN, CONN., U. S. A.
Manufacturer of
MAST ARMS, POLE and SWITCHING HOODS, HOUSE BRACKETS and other specialties for construction work
Catalogue and Prices Furnished on Application

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Switches, Receptacles and Remote Control

THE HART MANUFACTURING CO., Hartford, Conn.

TRADE MARKS THAT GUARANTEE QUALITY
Electric Railway Line Material, Charging Plugs and Receptacles, Ajax Lightning Arresters, Switches and Switchboard Appliances, Automatic Time Switches

Albert & J. M. Anderson Mfg. Co.
Established 1877
289-293 A St. Boston, Mass.

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MESCO

Snap Switches, Push Button Switches, Separable Attachment Plug, and some other things.
Mesco Products' Catalog mailed to the trade. Mention Electrical Review.

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TOOLS

for all classes of electrical construction and repair work. Write for catalog.

Mathias Klein & Sons Canal Station 28 Chicago

APOLLO Special ELECTRICAL SHEETS

Of Silicon Alloy Steel, Patented. Highest grade Electrical Sheets manufactured for transformers, dynamos and motors; insuring minimum heating, maximum capacity, non-aging. Other standard sheets are American Armature, U. S. Electrical, and Pole Face. Write for full information.

AMERICAN SHEET AND TIN PLATE COMPANY, Pittsburgh

AMERICAN SHEET & TIN PLATE CO. APOLLO SPECIAL ELECTRICAL TRADE MARK REGISTERED PITTSBURGH

Quick Shipments of Poles and Cross Arms From Our Minneapolis Yard.
Butt Treating Open Tank "GOOD" POLES "QUICK" "Hot and Cold" Processes
THE LINDSLEY BROTHERS CO. 72 West Adams St., Chicago
SPOKANE
ST. LOUIS

CRAWFORD CEDAR CO.
MENOMINEE, MICH.
Northern White Cedar—Western Red Cedar—Woods Run—POLES—Plain or Treated Butts QUICK SHIPMENTS
Sales Representatives: Wm. Mueller & Co., 1729 McCormick Bldg., Chicago, Ill.

W. C. STERLING & SON CO.
POLES OF STERLING QUALITY
Oldest Cedar Pole Firm in Business Producers for 36 Years
MICHIGAN and WESTERN CEDAR
W. C. STERLING & SON COMPANY
1880 MONROE, MICHIGAN 1916

THE VALENTINE-CLARK CO.
CEDAR POLES Butt Treating Open Tank Process
MINNEAPOLIS, MINN.
Toledo Chicago St. Maries, Idaho

CEDAR POLES
Write for Prices. Prompt Shipments from Wisconsin or Chicago Switching District Yard on I. H. Belt R. R.
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POLES WESTERN CEDAR PILING
We brag about the SERVICE we give. Commit us to memory
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NAUGLE POLE & TIE CO.
2307 S. MORGAN ST. CHICAGO ILL.
The Trinity in Poles "Service"-"Price"-"Quality"
POLES

POLES
NORTHERN WHITE CEDAR WESTERN RED CEDAR
BUTT TREATING
PAGE & HILL CO.
MINNEAPOLIS, MINN.

NORTHERN-WESTERN CEDAR POLES
A FULL ASSORTMENT OF SIZES
PROMPT SHIPMENTS ASSURED
T. M. PARTRIDGE LUMBER COMPANY
Lumber Exchange MINNEAPOLIS

JOHN H. FOWLER CO.
Estab. 1900.
FISHER BLDG. CHICAGO
CEDAR POLES
MAIN YARD CHICAGO

BIG-BUTTED-BOVILL-POLES
FROM
BOVILL, IDAHO
E. T. CHAPIN CO.
Eastern Storage Yard
MINNEAPOLIS MINN.
Manufacturing Headquarters and Treating Plants, BOVILL, IDAHO
Gen'l Office SPOKANE, WASH.
Eastern Sales Office ST. LOUIS MO.

CEDAR POLES
FROM THE STUMP TO THE LINE
NATIONAL POLE CO. ESCANABA MICHIGAN

OVER a quarter of a century devoted to the making and distributing of Columbia lamps not only guarantees Columbia MAZDA quality, but has made possible a highly developed service to distributors in the way of engineering, sales and advertising co-operation.
The Columbia Lamp Division
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1201 Title Guaranty Bldg., 706 Chestnut St.
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Branch Offices — Boston, New York, Philadelphia, Memphis
COLUMBIA
MAZDA

Best Grade Renewed Lamps
Both Carbon and Tungsten Types
We guarantee you most for the money
BOSTON-ECONOMY LAMP DIVISION
National Lamp Works of General Electric Co.
128 MAPLE STREET DANVERS, MASS.

SEAMLESS RUBBER SAFETY INSULATIONS
SAFETY INSULATED WIRE & CABLE CO.
114 LIBERTY ST., NEW YORK
CHICAGO BOSTON
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LUX LAMPS
NITROS, CONCENTRATED, TUNGSTEN
Highest Quality, Greatest Efficiency, Longest Life
Lux Mfg. Co., Hoboken, N. J.

"MANROSS" HAIR SPRINGS
For Electric Indicating and Recording Gauges, Steam Gauges, etc. Largest Manufacturers of
HAIR SPRINGS
in the United States. Electrical Instrument Hair Springs are made from our Special Bronze-Alloy.
F. N. MANROSS & SONS, Bethlehem, Conn.

Headquarters for Electrical Supplies
The Best of Everything

Arc Lamps	Dynamos	Chafing Dishes	Luminous Radiators
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Carbons	Motors	Disc Stoves	Toasters
Cords	Sockets	Flat Irons	Vacuum Cleaners
Cut-Outs	Switches	Heating Pads	Washing Machines
			Electric Ranges

Miniature, Decorative Tungsten and Carbon Lamps

Make your Electrical purchases here and have the assurance of absolute satisfaction and quality.

Commonwealth Edison Company
Edison Building, 72 West Adams Street
CHICAGO
Branch Supply Store: 5601 Lowe Avenue

The Dim-A-Lite, shown above — a device to turn down electric lights when full light is not required.

405-A

No. 5339. Showing Contractile Screw Collar

Locking Spring No. 6170

HUBBELL Shade Holders

Fit Both Plain and Threaded Socket Shells

YOU don't have to use two styles of holders for plain and threaded shells. The Hubbell Holder with contractile screw collar is the one that does the work of two. It fits all sockets whether beads are plain or threaded.

Easy to Adjust
Safe to Trust

The Hubbell Screw Collar snaps around the socket shell. The holder screws to the collar. Every turn of the holder pinches the collar tighter around the shell.

Hubbell Holders grip the socket like a vise—will not loosen, slip, tilt or bend. They do what shade holders ought to do—hold the shade securely and in perfect alignment with the lamp.

Harvey Hubbell, Inc.

Bridgeport, Conn.

HUBBELL

IN STOCK

for

Immediate Delivery

BANNER BRAND Weatherproof Wire

Triple Braid

Sizes Nos. 14 to 00

Rubber Covered Wire

In Sizes
No. 18 to 1,000,000 C. M.

And a Great Quantity of All Standard

Electrical Supplies

Our Proposition May Save You Both Time and Money

Central Electric Company

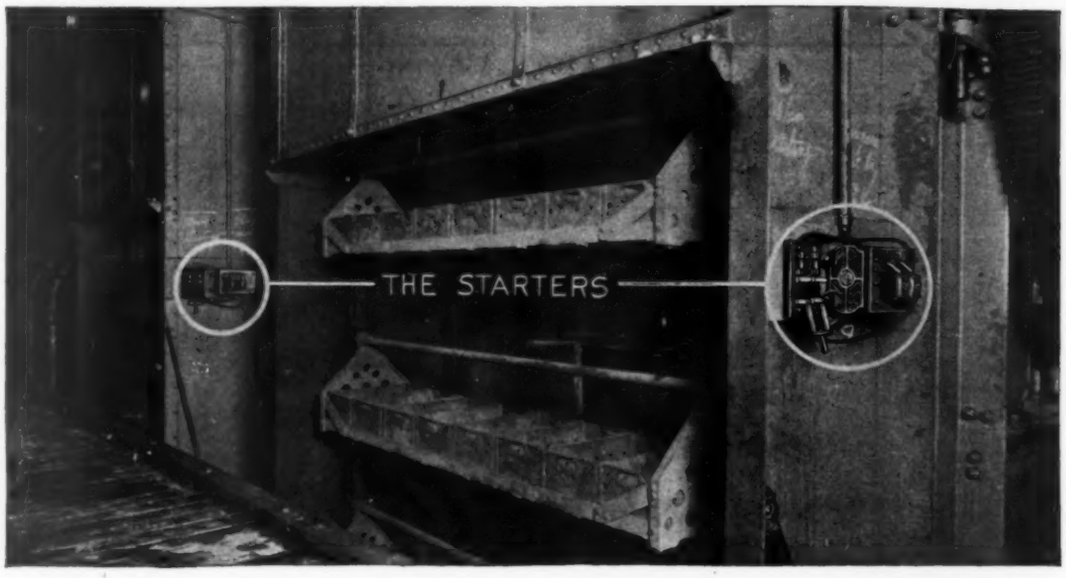
The House of Service

Chicago

OKONITE TRADE MARK REG. U.S. PAT. OFFICE

OKONITE TRADE MARK REG. U.S. PAT. OFFICE

E. C. & M. Automatic Motor Starters
Applied to Motor-Driven Pasteurizers



To start the motor, the workman *simply* closes the knife switch.

To stop the motor, he opens the knife switch.

This application is only one of thousands that have been made in breweries, candy factories, machine shops, steel mills and, in fact, almost every industry that employs electric motors.

As the name implies, this Starter is absolutely automatic and does the thinking for the operator.

Write for Bulletin 1016.

THE ELECTRIC CONTROLLER & MFG. CO.
NEW YORK-50 CHURCH ST.
PITTSBURG-OLIVER BLDG.
BIRMINGHAM-BROWN-MARX BLDG.
CLEVELAND, OHIO.
CHICAGO-MONADNOCK BLK
DENVER-IDEAL BUILDING
TORONTO-TRADERS BANK BLDG.

CUTLER-HAMMER

Easy to Get At

Just Remove Two Bolts

After removing a bolt at top and bottom the contact fingers may be removed.

and you can lift out the contact fingers as shown in the illustration. This is a C-H feature that those experienced in crane and hoist service consider of great importance.

C-H Drum Controllers
For Crane and Hoist Service

because of their superior rugged construction provide the most precise operation. Each speed point can be distinctly felt by the operator;—yet the operation is smooth.

The straight line non-stubbing fingers, first employed on Cutler-Hammer controllers, are now mounted on a square metal shaft. This can be removed in one piece as shown above.

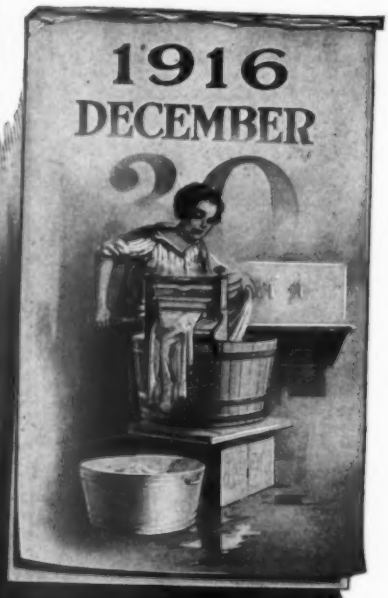
Exterior View of C-H Drum Controller

The Cutler-Hammer Mfg. Co.
Milwaukee, Wisconsin

Largest Manufacturers of Motor Control Apparatus in the World

New York Boston Pittsburgh Chicago Philadelphia
Cleveland Cincinnati San Francisco

Wring out the Old—Wring in the New



May washboard rubbing and hand wringing end with the old year.

Womankind deserves a better method---and wants it.

Let the New Year also bring a new regime to the electrical dealer. May he take advantage of his opportunities to sell the

Western Electric
Washer and Wringer

And may bell and push button sales be supplemented by more profitable sales of the Western Electric Washer and Wringer.

Plan now for a bigger, better business for 1917---consult our nearest house.

SAVE TIME AND FREIGHT

DYNAMOS-MOTORS WESTERN ELECTRIC COMPANY CABLES-TELEPHONES-SUPPLIES

TELEPHONE OUR NEAREST HOUSE

Western Electric Company
INCORPORATED

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Newark	Savannah	Indianapolis	Dallas	Los Angeles
Philadelphia	New Orleans	Detroit	Houston	Seattle
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EQUIPMENT FOR EVERY ELECTRICAL NEED

MEMBER OF SERVICE THE SOCIETY FOR ELECTRICAL DEVELOPMENT INC NEW YORK ECONOMY RELIABILITY SAFETY

"DO IT ELECTRICALLY"

This Trade Mark The Guarantee of Excellence on Goods Electrical.

You Can Permanently Protect Your Plant

against the extremely disastrous results of short circuits by one relatively small investment.

The G-E Cast-In Reactor

once installed, becomes a permanent watchman—always on duty to throttle the heavy disturbances and thus protect your service at all times.

General Electric Company

General Office: Schenectady, N. Y.

Sales Offices in All Large Cities

6360

This Trade Mark The Guarantee of Excellence on Goods Electrical.

THERE has been no other factor in creating the prestige which now surrounds the Weston name than the outstanding superiority of

Weston

Indicating Instruments

So high have Weston products established the name in the field of Electrical Measurement that it is in itself an endorsement of each instrument that bears it. It is our fixed purpose to maintain, and if possible, to increase, the value of this endorsement.

The Weston A. C. Round Pattern Switchboard Group includes Ammeters, Voltmeters, Wattmeters (Single and Polyphase), Power Factor Meters, Frequency Meters and Synchroscopes.

These instruments have points of marked superiority over any others intended for the same purpose. Besides their extreme accuracy and serviceability, they are highly desirable for their uniformity of size and style, the openness of their scales and their legibility from any angle.

Weston Indicating Instruments include a great variety of groups for portable or switchboard service on A. C. or D. C. Circuits. Instruments designed expressly for testing and laboratory use, for motor car and boat electrical systems, and many others for special purposes. Write for Bulletins or Catalogs describing those which interest you.

Weston Electrical Instrument Co.
19 Weston Ave., Newark, N. J.

New York	Chicago	Detroit
Boston	St. Louis	San Francisco
Philadelphia	Richmond	Toronto
Pittsburgh	Denver	Montreal
Buffalo	Cincinnati	Winnipeg
Cleveland		Vancouver

WIRED WITH SIMPLEX

New Buildings
of the
Massachusetts Institute of Technology

SIMPLEX WIRE & CABLE Co
MANUFACTURERS
201 DEVONSHIRE ST. BOSTON
CHICAGO SAN FRANCISCO

1634

THE STANDARD FOR RUBBER INSULATION

OKONITE

YOUR confidence is an asset not to be abused. We make but one grade of insulation — OKONITE. Its service compels confidence.

The
Okonite Company
253 Broadway, New York

INDIANA RUBBER AND INSULATED WIRE CO.

Paranite Rubber Covered Wires and Cables

IF IT'S **PARANITE** IT'S RIGHT

More Than Code Requires

PARANITE TRADE MARK

Underground, Aerial, Submarine and Inside use

Telephone, Telegraph and Fire Alarm Cables, Lamp Cords, Portable Cords and Ignition Cables

Factory and General Offices:
JONESBORO, IND.

Chicago Branch: 210 Desplaines St.
Chicago, Illinois

Pittsburgh Transformer Company

Largest Manufacturers of Transformers Exclusively
in the United States
Pittsburgh, Pa.

PERU

Porcelain and Wiring Appliances
made to order to specifications
Send drawing or model for estimate
PERU ELECTRIC CO.
PERU, IND.

DUNCAN METERS
AND
TRANSFORMERS

"Everybody knows the Duncan products"

Duncan Electric Mfg. Co.
Lafayette, Ind.

FUSES
Arresters
Voltage Detectors

S C

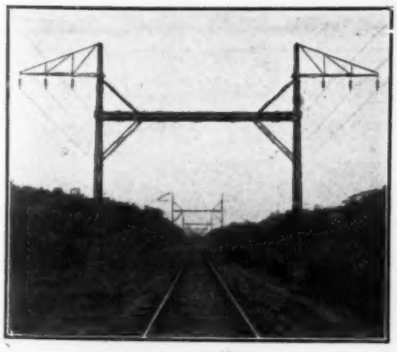
High Voltage Specialties

SCHWEITZER & CONRAD, Inc.
1770 Berteau Avenue
CHICAGO

HIGH TENSION
STEEL TOWER OUTDOOR SUB-STATIONS
DELTA STAR ELECTRIC CO. CHICAGO
ICE PROOF POLE TOP P.M. SWITCHES
ASK FOR TECHNICAL BULLETINS

AMERICAN BRIDGE COMPANY
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly **BRIDGES AND BUILDINGS**



Track Spans, Panama

SALES OFFICES

NEW YORK, N. Y., 30 Church Street
Philadelphia, Pa., . Widener Building
Boston, Mass. . . John Hancock Bldg.
Baltimore, Md., Continental Trust Bldg.
PITTSBURGH, PA. . . Frick Building
Rochester, N. Y. . . . Powers Block
Buffalo, N. Y. . Marine National Bank
Cincinnati, Ohio. Union Trust Building
Atlanta, Ga. . . . Candler Building
Cleveland, Ohio . Rockefeller Building
Detroit, Mich., Beecher Ave. & M. C. R. R.
CHICAGO, ILL., 208 South La Salle St.
St. Louis, Mo., Third Nat'l Bank Bldg.
Denver, Colo., First Nat'l Bank Building
Salt Lake City, Utah, Walker Bank Bldg.
Duluth, Minn. . . . . Wolvin Building
Minneapolis, Minn., 7th Ave. & 2nd St., S. E.

Pacific Coast Representative:
U. S. Steel Products Co. Pacific Coast Dept.
SAN FRANCISCO, CAL., Rialto Building
Portland, Ore. . . . . Selling Building
Seattle, Wash., 4th Ave. So. Cor. Conn. St.

Export Representative:
United States Steel Products Co., 30 Church St., N. Y.

ELECTRICAL EXCHANGE

POSITION WANTED

The rate for "Positions Wanted" advertisements is two cents per word, minimum charge 50 cents an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

POSITION WANTED—Electrical engineer, 34, married, technical education, eight years' practical training in motor application and salesmanship. Capable of making engineering reports and recommendations for electrical drive. Address No. 3039, Electrical Review and Western Electrician, Chicago.

HELP WANTED

The rate for "Help Wanted" advertisements is three cents a word, minimum charge $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

WANTED—Young technical graduates wanted for test floor work by a large manufacturer of electrical machinery. Broad training and exceptional opportunities for qualified men. Give full particulars regarding education and practical experience in first letter. Box No. 911, Pittsburgh, Pa.

WANTED—An energetic and capable young man to assume the position of Superintendent of a Municipal Water and Light Plant.

Plant is in good physical condition, and has made money from its inception. A young man with technical education and some years' experience in the same capacity preferred. State age, schooling, and experience, and send copies of references in first letter. Address M. W. Younkin, Superintendent, City Water and Light Plant, Paris, Tenn.

WANTED—Experienced structural steel draftsman for work out of town. Must have experience in both designing and detailing. Address No. 3038, Electrical Review and Western Electrician, Chicago.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements is three cents a word, minimum charge of $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

FOR SALE—Eight thousand pounds of No. 3 asbestos and single cotton covered magnet wire, manufactured by Electric Cable Company. On original reels and in perfect condition. If interested write W. H. Smaw, Pur. Agt., Georgia Ry. & Power Co., Atlanta, Georgia.

America's Headquarters for

Second Hand Electrical Machinery

Overhauled in our shops and sent out "as good as new" with a satisfactory guarantee. We buy—sell—repair—rent and exchange—and are always ready for a trade. No quantity too large. Send for our "Monthly Bargain Sheet," showing net prices.

GREGORY ELECTRIC CO.
CHICAGO, ILLINOIS

NATIONAL ELECTRICAL EXCHANGE
AURORA, ILL.

FOR SALE—220 V. Motors:—One each, 75 H. P.—15 H. P. and 3 H. P. 2 phase; also 20 H. P., 3 phase, all 60 cycle; 1-20 H. P. direct current.

FOR SALE—Four 3½ H. P. direct load 500 Volt D. C., series wound fully enclosed standard Crocker Wheeler Crane motors, extra extension shaft, equipped with solenoid brake. Four 1½ H. P. 500 Volt D. C., series wound fully enclosed Standard Crocker-Wheeler Crane motors. These motors are in first-class shape. Will quote low figure for prompt disposition. Address, Geo. M. Ryall, 390 Pacific Electric Building, Los Angeles, Cal.

PROPOSALS

The rate for "Proposal" advertisements is fifteen cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., December 6, 1916.—Sealed proposals will be opened in this office at 3 p. m., January 4, 1917, for the remodeling of an electric passenger elevator in the United States post office and customhouse at Galveston, Tex., in accordance with the specification, copies of which may be had at this office in the discretion of the Supervising Architect. —James A. Wetmore, Acting Supervising Architect.

Sealed bids will be received by the Town of Douglas, Wyoming, for furnishing the Municipal Water Works with Centrifugal pumps.

Specifications can be had by applying to the City Clerk after Dec. 15, 1916. The Council reserves the right to reject any or all bids. Bids to be accompanied by a certified check for $200.00.

H. S. Datesman, City Clerk. W. H. Anthens, Mayor.

BOUSTEAD ELEC. & MFG. CO.
NEW AND USED ELECTRICAL MACHINERY
SWITCHBOARDS
ARMATURE AND TRANSFORMER WINDING
REPAIRING
215 1st Ave. North Minneapolis, Minn.

ALTERNATORS
Vertical Type
67% Larger Income—Same Cost. For direct coupling to water-wheel shafts for Power and Lighting Service. 20 K.W. to 1,000 K.W.
Electric Machinery Company
Minneapolis - - Minn.

NEW AND USED
Electrical and Steam Equipment
Alternating and Direct Current Units, Belted Dynamos, Engines, Rotary Converters and Transformers, Motor Generator Sets, Motors, etc., always in stock. The largest manufacturers in the country are installing used apparatus and hundreds of them are among our regular customers. Write to us for some of their names and also for our latest list of apparatus on hand.
MacGovern & Company, Inc.
14 Liberty Street, New York, N. Y.

Turbo Generators
Immediate Delivery
Two Westinghouse Parsons 300 K.W. direct connected Turbo generators, 60 cycle, 3 phase, 440 volts, exciters on same shaft; 150 lbs. or 200 lbs. steam pressure.
Two Wheeler surface condensers. Brass tubes with brass lined air pumps mounted integral with condensers.
One 30 H.P. Induction Motor Generator Set, 440 volts, 3 phase, 60 cycle motor, 110 volts, 850 R. P. M. generator; 3 Panel Switchboard, one panel for each generator and one for exciter units, with appropriate instruments and wiring.
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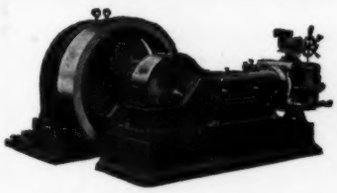

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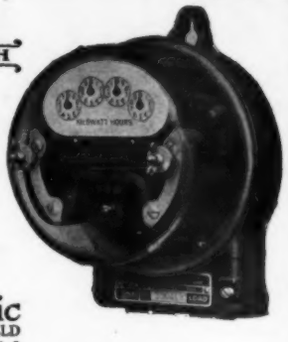

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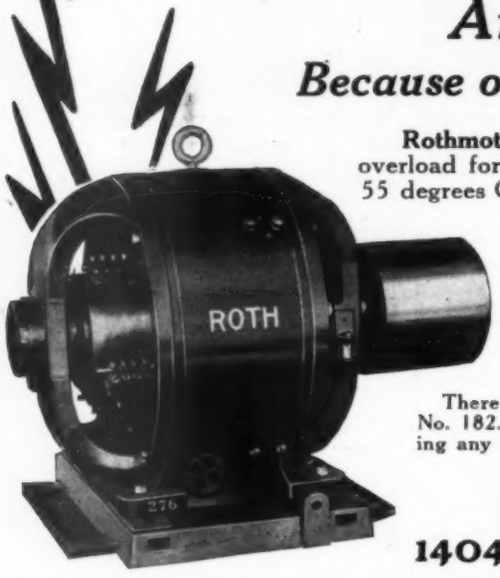

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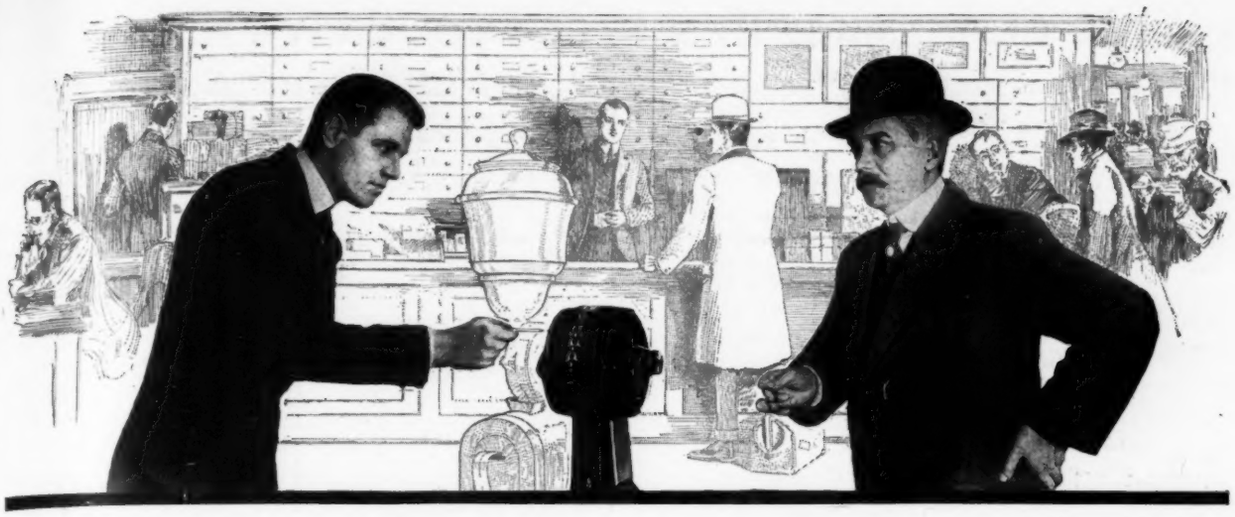

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Stone & Webster Eng. Corp.
White Companies, J. G.

CONTROLLERS, AUTOMATIC, for Automobile Lighting Systems.
Ward-Leonard Electric Co.

CONTROLLERS, Printing Press.
Allis-Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co.

CONVERTERS, ROTARY.
Fairbanks, Morse & Co.
General Electric Co.
Northwestern Electric Co.

COOKING DEVICES, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Globe Stove & Range Co.
Hughes Electric Heating Co.
Manhattan Electrical Supply Co.
Ruvio Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

COPPERS, Battery.
Manhattan Electrical Supply Co.
Western Electric Co.

CORD, Braided:
Samson Cordage Works.

CRANES AND HOISTS.
Allis-Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
Sprague Electric Works.

CRANE MOTORS.
Crocker-Wheeler Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CROSS ARMS (Wood).
American Bridge Co.
Lindsley Brothers Co.

CURLING IRONS, Electric.
Central Elec. Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Enclosed Fuse, Plug, Combination Rosette, Cut-Out Bases.
Bryant Electric Co.
C. & P. Electric Works.
Central Electric Co.
Chicago Fuse Mfg. Co.
Commonwealth Edison Co.
D & W Fuse Co.
General Electric Co.
Hart Mfg. Co.
Manhattan Electrical Supply Co.
Trumbull Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co.
Bryant Electric Co.
Cutter Co., George.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Metropolitan Engineering Co.

CUT-OUTS, Transformer.
Central Electric Co.
D & W Fuse Co.
General Electric Supply Co.
Delta-Star Electric Co.
General Electric Co.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

DAMS, MOVABLE.
American Bridge Co.

DECORATIVE LIGHTING.
Central Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.

DERRICKS.
American Bridge Co.

DIRECT MOTOR DRIVES.
Crocker-Wheeler Co.
Electric Machinery Co.
Electric Controller & Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
Roth Bros. & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

DOOR SWITCHES.
Cutler-Hammer Mfg. Co.
Hart Mfg. Co.

DRILLS AND BITS, Electricians'.
Morse Twist Drill & Machine Co.
Hubbard & Co.

EGG COOKERS.
Ruvio Electric Co.

ELECTRIC VEHICLES.
General Vehicle Co.

ELECTRO-PLATING MACHINERY.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Sprague Electric Works.
Westinghouse Electric & Mfg. Co.

ENGINEERS & CONTRACTORS
American Bridge Co.
Arnold Co.
Baehr, Wm. A.
Badt-Westburg Electric Co.
Byllesby & Co., H. M.
Jackson, D. C. & W. B.
Lyndon, Lamar.
McMeen & Miller.
Norton, Bird & Whitman.
Pillsbury, Chas. A.
Sargent & Lundy.
Stone & Webster Engineering Corporation.
Western Electric Co.
White Companies, J. G.
Woodmansee & Davidson, Inc.

ENGINES, Gas and Gasoline.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
Westinghouse Machine Co.

ENGINES, OIL.
Fairbanks, Morse & Co.

ENGINES, Steam.
Allis-Chalmers Manufacturing Co.
Murray Iron Works Co.
Ridgway Dynamo & Engine Co.
Westinghouse Machine Co.

FANS, Motor and Disc.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Hunter Fan & Motor Co.
Manhattan Electrical Supply Co
Peerless Electric Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FAULT FINDERS, Electric.
Electric Controller & Mfg. Co.

FIBRE.
Continental Fibre Co.
Diamond State Fibre Co.

FIRE ALARMS.
Palmer Electric & Manufacturing Co.

FIREPLACES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.
Adapti Co., The.
Killark Electric Mfg. Co.
National Metal Molding Co.
Phelps, James C.
Sprague Electric Works.

FIXTURES, Electric and Gas.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Co.
Central Electric Co.
Delta-Star Electric Co.
Faries Mfg. Co.
Moran & Hastings Mfg. Co.
Robert Findlay Mfg. Co., Inc.
Western Electric Co.

FIXTURES, Indirect and Semi-Indirect Lighting.
Beardslee Chandelier Mfg. Co.
Central Electric Co.
General Electric Co.
Moran & Hastings Mfg. Co.
Robert Findlay Mfg. Co., Inc.

FIXTURES, Show Case.
Benjamin Electric Mfg. Co.
Central Electric Co.
Johns-Manville Co., H. W.

FLASHERS, Sign.
Campbell Electric Co.

FLASHLIGHTS.
Delta-Star Electric Co.

FLAT IRONS, Electric.
Central Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
International Electric Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FLUXES, Soldering.
Allen Co., Inc., L. B.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Chicago Fuse Mfg. Co.
McGill Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

FORGINGS.
American Bridge Co.

FUSE PLUGS.
Anderson Mfg. Co., Albert & Atlas Selling Agency.
Bryant Electric Co.
D & W Fuse Co.
Daum, A. F.
General Electric Co.
Stanley & Patterson.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FUSE WIRE.
Chicago Fuse Mfg. Co.
General Electric Co.
Western Electric Co.

FUSES.
Bryant Electric Co.
Central Electric Co.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Daum, A. F.
Delta-Star Electric Co.
Economy Fuse & Mfg. Co.
Electrical Engineers Equipment Co.
Federal Sign System (Electric).
General Electric Co.
Hickey & Schneider.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.
Star Fuse Co.
Westinghouse Electric & Mfg. Co.

GATES, HEAD.
American Bridge Co.

GEARS, Rawhide and Composition.
Diamond State Fibre Co.
General Electric Co.
New Process Gear Corp.

GENERATORS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Ridgway Dynamo & Engine Co.
Star Dynamo Co
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

GLASSWARE, Illuminating.
Central Electric Co.
Ivanhoe-Regent Works of General Electric Co.
Western Electric Co.

GLOBES, Arc Light. (Outer and Inner.)
General Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

GRATES.
Murray Iron Works Co.

GROUND CLAMPS.
General Electric Co.
Hart Mfg. Co.
Hubbard & Co.
Sprague Electric Works.
Thomas & Betts Co.
Western Electric Co.

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co.
Hubbell, Inc., Harvey.
McGill Mfg. Co.

GUY CLAMPS.
American Steel & Wire Co.
Hubbard & Co.

HAIR DRYERS, Electric.
Shelton Electric Co.

HANGERS, Conduit and Moulding.
Western Electric Co.

HANGERS AND CLAMPS.
Ohio Brass Co.
Ostrander & Co., W. R.
Sprague Electric Works.
Standard Underground Cable Co.
Steel City Electric Co.
Thomas & Betts Co.

HEATERS, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Lee Electric Radiator Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

HEATERS, Water.
Bridgeport Electric Mfg. Co.

HEATING SYSTEMS, Exhaust Steam.
American District Steam Co.

HOISTING MACHINERY, Electric Mine.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
General Electric Co.

HYDRAULIC MACHINERY.
Allis-Chalmers Manufacturing Co.

INCLINATORS, CARBOY
McCord & Co., Horace.

INSTRUMENTS.
Bristol Co.
Electric Controller & Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Leeds & Northrup Co.
Manhattan Electrical Supply Co.
Metropolitan Engineering Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.

INSULATING CEMENTS.
Mechanical Rubber Co.
Westinghouse Electric & Mfg. Co.

INSULATING MACHINERY.
Hubbell, Inc., Harvey.
New England Butt Co.

INSULATING PAINTS AND COMPOUNDS.
Chicago Mica Co.
Electrical Engineers Equipment Co.
McGill Mfg. Co.
Mechanical Rubber Co.
Mica Insulator Co.
Sherwin-Williams Co.
Standard Paint Co.
Standard Underground Cable Co.
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATION, Hard Rubber Composition, Etc.
Continental Fibre Co.
Electrose Mfg. Co.
Hemming Mfg. Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Arc Lamp.
Anderson Mfg. Co., Albert & J. M.
Cutter Co., George.
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg Co.

INSULATORS, Glass.
General Electric Co.
Hemingray Glass Co.
Locke Insulator Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, High Voltage.
Electrical Engineers' Equipment Co.
Electrose Mfg. Co.
General Electric Co.

CLASSIFIED INDEX—Continued

Locke Insulator Mfg. Co.
Ohio Brass Co.
Thomas R., & Sons Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Wood.
Westinghouse Electric & Mfg. Co.

INSULATOR SUPPORTS.
Clark Electric & Mfg. Co.
Hickey & Schneider.

INSURANCE.
Utilities Fire and Liability Indemnity Exchanges.

IRIDIO-PLATINUM.
Baker & Co., Inc.

JARS, Battery (Glass).
Hemingray Glass Co.

JOINTS, Cable.
General Electric Co.

JOINTS, Fixture Insulating.
Faries Mfg. Co.
Thomas & Betts Co.

LAMP REGULATORS, INCANDESCENT.
Anylite Electric Regulator Co.

LAMPS, Arc.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LAMPS, Incandescent.
Anchor Electric Co.
Central Electric Co.
Deuth & Co., Inc.
Edison Lamp Works of General Electric Co.
Franklin Electric Mfg. Co.
Hubbell, Inc., Harvey.
Lux Mfg. Co.
National Lamp Works of General Electric Company, comprising the following member divisions:
American Electric Lamp Division.
Banner Electric Division.
Boston Economy Lamp Division.
Brilliant Electric Division.
Bryan-Marsh Electric Division.
Buckeye Electric Division.
Colonial Electric Division.
Columbia Incandescent Lamp Division.
Economical Electric Lamp Division.
Elux Miniature Lamp Division.
Federal Miniature Lamp Division.
Fostoria Incandescent Lamp Division.
General Incandescent Lamp Division.
Monarch Incandescent Lamp Division.
Munder Electric Division.
Packard Lamp Division.
Peerless Lamp Division.
Shelby Lamp Division.
Standard Electric Division.
Sterling Electric Lamp Division.
Sunbeam Incandescent Lamp Division.
New York Electric Lamp Co.
Western Electric Co.
Westinghouse Lamp Co.

LAMPS, MINIATURE.
Mannweiler Co., A. C.

LAMPS, Vapor and Vacuum Tube.
General Electric Co.

LANTERNS.
Manhattan Electrical Supply Co.

LIGHTING PLANTS.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
Delta-Star Electric Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Railway and Industrial Engineering Co.
Schweitzer & Conrad, Inc.
Westinghouse Electric & Mfg. Co.

LIGHTS, Desk.
Faries Mfg. Co.

LIGHTS, Stage.
General Electric Co.

LINE MATERIALS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LOCKS, Meter.
Acme Electric Meter Lock Co.

LOCOMOTIVES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LUGS.
Chicago Fuse Mfg. Co.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
General Electric Co.
Trumbull Electric Mfg. Co.

MAGNETIC SWITCH CONTROLLERS.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sundh Electric Co.
Westinghouse Electric & Mfg Co.

MAGNETOS, MAGNETO-GENERATORS AND BELLS.
Manhattan Electrical Supply Co.
Western Electric Co.

MAGNETOS, Ignition.
General Electric Co.
Manhattan Electrical Supply Co.

MAGNETS, Electro.
Acme Wire Co.
Belden Mfg. Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Manhattan Electrical Supply Co.
Sundh Electric Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Sundh Electric Co.
Western Electric Co.

MAGNETS, Permanent.
Western Electric Co.

MARINE FIXTURES.
Benjamin Electric Mfg. Co.
Delta-Star Electric Co.
General Electric Co.

MAST ARMS.
Brady Electric Mfg. Co.
Cutter Co., George.
General Electric Co., Ft. Wayne Dept.
Pittsburgh Transformer Co.

MEASURING MACHINES (For Wire Measuring).
Minneapolis Electric & Construction Co.
New England Butt Co.

MEDICAL APPARATUS.
Bleadon-Dunn Co.

METAL FITTINGS.
Peru Electric Co.

METERS, Recording.
Bristol Co.
General Electric Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Westinghouse Electric & Mfg. Co.

MICA.
Chicago Mica Co.
Mica Insulator Co.

MINING MACHINERY (Motor Driven).
Allis - Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

MOLDED INSULATION.
Cutler-Hammer Mfg. Co.
Hemming Mfg. Co.
Westinghouse Electric & Mfg. Co.

MOTORS AND DYNAMOS.
Advance Electric Co.
Allis-Chalmers Manufacturing Co.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Emerson Electric Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Peerless Electric Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Sprague Electric Works.
Star Dynamo Co.
Wagner Electric Mfg. Co.
Warner Electric Co., R. P.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Wisconsin Electric Co.

MOULDING.
American Conduit Mfg. Co.
National Metal Molding Co.
Trumbull Electric Mfg. Co.

OZONIZERS.
General Electric Co.

PACKING, Steam.
New York Insulated Wire Co.

PAINTS, Preservative.
Standard Paint Co.
Mechanical Rubber Co.

PAPER, Insulating Paper, Fuller Board, Press Board.
Diamond State Fibre Co.
Mechanical Rubber Co.

PATENT SOLICITORS.
Duvall, Edw. S.
Howe, Thomas.
Siggers, E. G.

PHOTOMETERS, Lamp Testing.
Leeds & Northrup Co.

PHOTOMETER STANDARDS.
Electrical Testing Laboratories.

PIGTAILS AND FLEXIBLE LEADS.
Belden Mfg. Co.
Rome Wire Co.

PINS AND BRACKETS, Wood.
Electrical Engineers' Equipment Co.
Ohio Brass Co.

PIPE COVERINGS, STEAM.
American District Steam Co.

PLATFORMS (Pole Seats).
Hubbard & Co.
Oshkosh Mfg. Co.

PLATINUM.
American Platinum Works.
Baker & Co., Inc.

PLIERS, Wire Cutting.
Bryant Electric Co.
Klein & Sons, Mathias.

PLUGS AND RECEPTACLES, Flush.
Bryant Electric Co.
Cutler-Hammer Mfg. Co.
Delta-Star Electric Co.
General Electric Co.
Hart Mfg. Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Trumbull Electric Mfg. Co.

PLUGS AND RECEPTACLES, Pawer.
Central Electric Co.

PLUGS AND RECEPTACLES, Stage.
Bryant Electric Co.
General Electric Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Western Electric Co.

POLES, Concrete.
American Steel & Wire Co.

POLES, Steel.
American Bridge Co.

POLES, Treated.
Bell Lumber Co.
Chapin, E. T., Co.
Crawford Cedar Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co
Page & Hill Co.
Partridge Lumber Co., T. M.
Sterling & Son Co., W. C.
Valentine-Clark Co.

POLES, Wood.
Bell Lumber Co.
Carney & Co., B. J.
Chapin, E. T., Co.
Crawford Cedar Co.
Duluth Log Co.
Fowler Co., John H.
Humbird Lumber Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co.
Northern White Cedar Ass'n.
Page & Hill Co.
Partridge Lumber Co., T. M.
Sterling & Son Co., W. C.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.
Western Red Cedar Ass'n.

POLE STEPS.
American Steel & Wire Co.
Anderson Mfg. Co., Albert & J. M.
Cutter Co., George.
Hubbard & Co.
Oshkosh Mfg. Co.

PORCELAIN, Special Shapes.
Cook Pottery Co.
Findlay Electric Porcelain Co.
General Porcelain Co
Hartford Faience Co.
Illinois Electric Porcelain Co.
Parker & Sons, J. H.
Peru Electric Co.
Thomas, R., & Sons Co.
Westinghouse Electric & Mfg. Co.

PORCELAIN, Standard.
Cook Pottery Co.
General Electric Co.
General Porcelain Co.
Hartford Faience Co.
Illinois Electric Porcelain Co.
Locke Insulator Mfg. Co.
Ohio Brass Co.
Thomas, R., & Sons Co.
Westinghouse Electric & Mfg. Co.

PORTABLES, Electric Reading Lamps.
Central Electric Co.
Faries Mfg. Co.
Herwig Art Shade & Lamp Co.

POSTS, Lamp.
Central Electric Co.
Cutter Co., George.
Delta-Star Electric Co.
Metropolitan Engineering Co.
Mohrlite Co.

POTENTIOMETERS.
Leeds & Northrup Co.

POTHEADS AND SLEEVES.
Brady Electric Mfg. Co.
Central Electric Co.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
General Electric Co.
Okonite Co., The.
Schweitzer & Conrad, Inc.
Standard Underground Cable Co.

POWER HOUSE SPECIALTIES.
Electrical Engineers Equipment Co.

PRODUCERS, Gas.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
Westinghouse Machine Co.

PROJECTORS, Electric. (Search Lights.)
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Western Electric Co.

PROJECTORS, Telephone.
D & W Fuse Co.

PYROMETERS, Electric.
Bristol Co.
Leeds & Northrup Co.

PULLEYS, Arc Lamp.
General Electric Co., Ft. Wayne Dept.
Cutter Co., George.
Fairbanks, Morse & Co.

PUMPS, STEAM AND POWER.
Fairbanks, Morse & Co.

PUMPS, Water.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.

PUSH BUTTONS.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

RACKS, Carboy.
McCord Co., Horace.

RACKS AND RINGS, Telephone Distributing.
Hubbard & Co.

RADIATORS.
General Electric Co.
Lee Electric Radiator Co.

RAIL BONDS.
American Steel & Wire Co.
General Elgctric Co.
Ohio Brass Co.
Western Electric Co.

RAIL JOINTS.
Ohio Brass Co.
Western Electric Co.

RAIL BOND TESTERS.
Roller-Smith Co.

RAILWAY SPECIALTIES, Electric.
Anderson Mfg. Co., Albert & J. M.
Blake Signal & Mfg. Co.
General Electric Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

RECEPTACLES, Sign.
Benjamin Electric Mfg. Co.
Bryant Electric Co.
General Electric Co.

RECEPTACLES, Weatherproof.
Bryant Electric Co.
General Electric Co.
Hubbell, Inc., Harvey.

RECORDERS, Time.
Bristol Company.

RECTIFIERS.
General Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

REELS, Wire.
Klein & Son, Mathias.
Minneapolis Elec. & Const. Co
Oshkosh Mfg. Co.

REFLECTORS, Glass and Steel.
Ivanhoe-Regent Works of General Electric Co.
(See Shades.)

REGULATORS, CURRENT.
Electric Appliance Co.
Packard Electric Co.

REGULATORS, INCANDESCENT LAMP.
Anylite Electric Regulator Co.

REPAIRS, Armature.
Boustead Electric & Mfg. Co.
Commonwealth Edison Co.
General Electric Co.
Westinghouse Electric & Mfg Co.

RESISTANCE, Banks and Units.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sprague Electric Works.
Sundh Electric Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg Co.

CLASSIFIED INDEX—Continued

RESISTANCE WIRE & RIBBON.
American Steel & Wire Co.
Belden Mfg. Co.
Driver-Harris Wire Co.
General Electric Co.
Moore, Alfred F.

REVERSING CONTROLLERS FOR CRANES, ETC.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

RHEOSTATS.
Allis-Chalmers Manufacturing Co.
Campbell Electric Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Sundh Electric Co.
Sprague Electric Works.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

RUNWAYS, CRANE.
American Bridge Co.

SCALES.
Fairbanks, Morse & Co.

SECOND HAND MACHINERY.
Boustead Electric & Mfg. Co.
C. J. & F. E. Briner.
General Electric Co.
Gregory Electric Co.
MacGovern & Co., Inc.
Randle Machinery Co.
St. Louis Portable Tool Co.

SHADE HOLDERS.
Bryant Electric Co.
Faries Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey.
Western Electric Co.

SHADES, GLASS.
Central Electric Co.
Beardslee Chandelier Mfg. Co.
Ivanhoe-Regent Works of General Electric Co.
Herwig Art Shade & Lamp Co.

SHADES, Metallic.
Benjamin Electric Mfg. Co.
Central Electric Co.
Cutter Co., George.
Faries Mfg. Co.
Hubbell, Inc., Harvey.
Ivanhoe-Regent Works of General Electric Co.
Ostrander & Co., W. R.

SHEDS, COAL STORAGE.
American Bridge Co.
Fairbanks, Morse & Co.

SHEDS, TRAIN.
American Bridge Co.

SHEETS, Iron and Steel.
American Sheet & Tin Plate Co.

SHOCK ABSORBERS.
Benjamin Electric Mfg. Co.

SIGNS, Electric.
Erickson Novelty Mfg. Co.
Federal Sign System (Electric).

SLATE.
Davis Slate & Mfg. Co.

SLEEVINGS.
Belden Mfg. Co.
Chicago Mica Co.
Standard Underground Cable Co.

SLEEVES, Paper.
Standard Underground Cable Co.

SLEEVES, Splicing.
Hickey & Schneider.

SOCKETS AND RECEPTACLES.
Benjamin Electric Mfg. Co.
Best Electric Co.
Bryant Electric Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Faries Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey.
Ostrander & Co., W. R.
Pass & Seymour, Inc.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SOCKETS, Locking.
Best Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Pass & Seymour, Inc.

SOLDERING IRONS.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

SPRINGS.
American Platinum Works.
American Steel & Wire Co.
Manross & Sons, F. N.

STACKS.
American Bridge Co

STAGE LIGHTING APPARATUS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
Kliegl Bros.
Universal Electric Stage Lighting Co.
Ward Leonard Electric Co.
Sundh Electric Co.

STANDARD CELLS.
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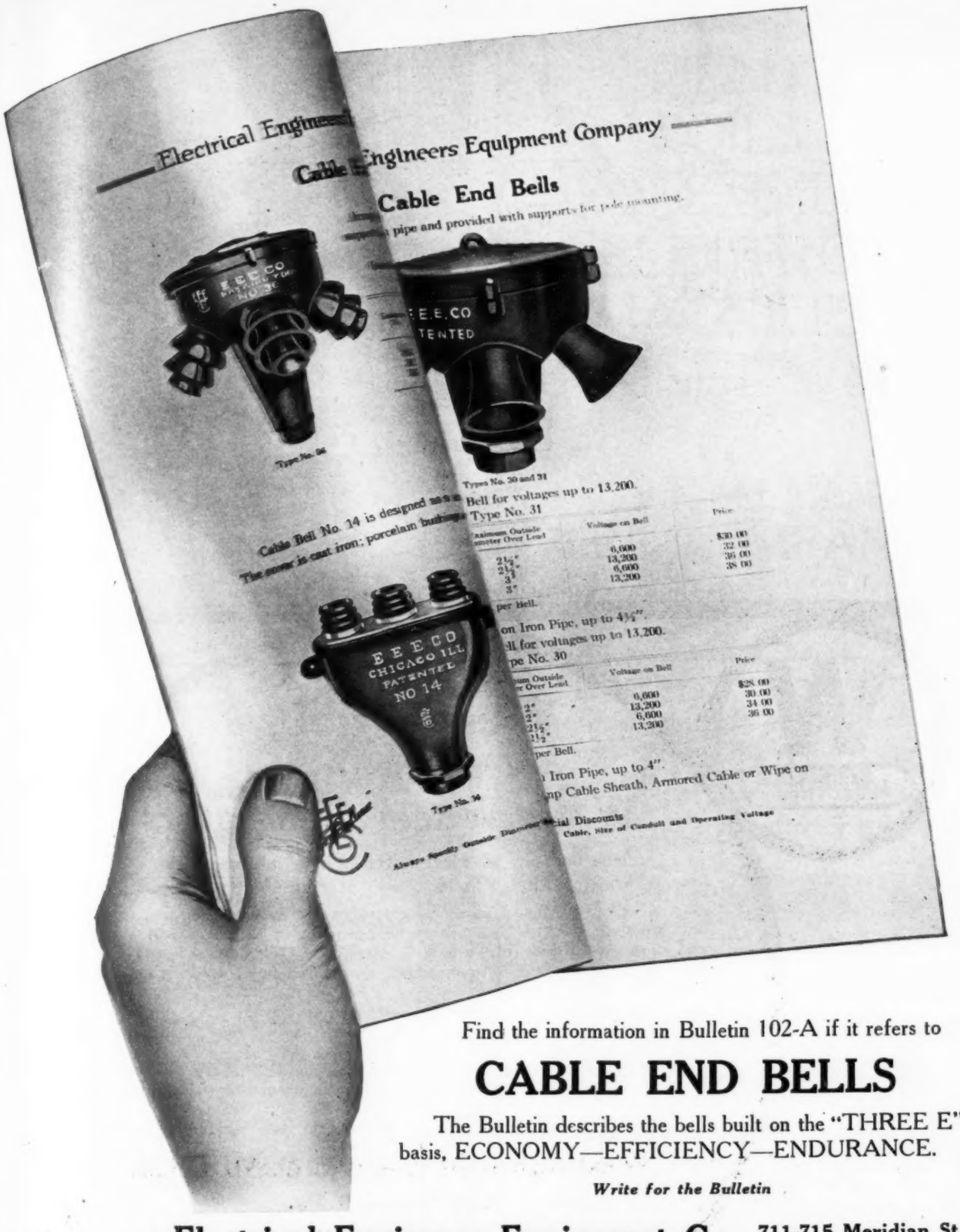
Read the Answer in the Names Above



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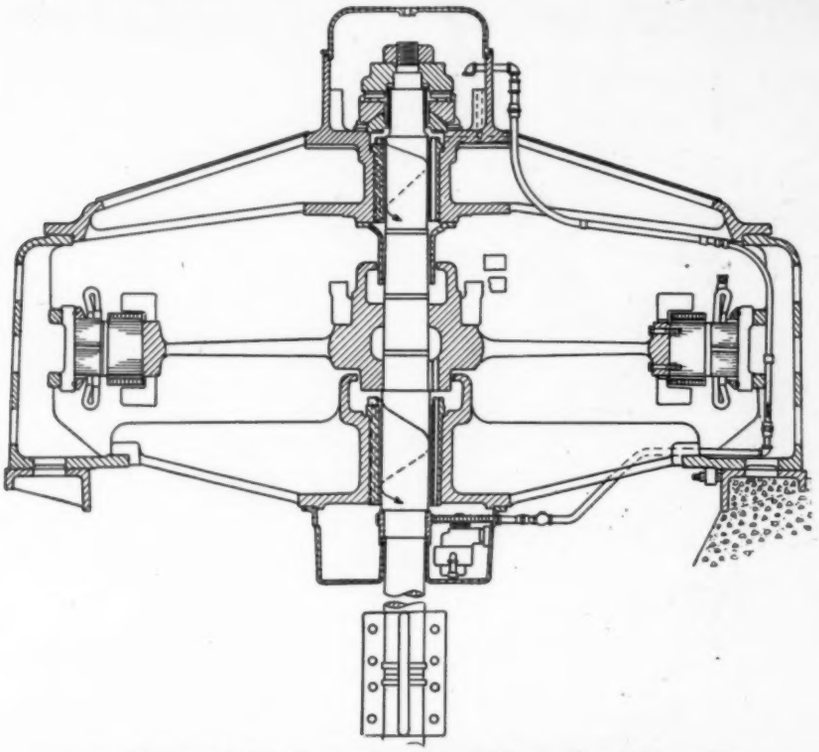

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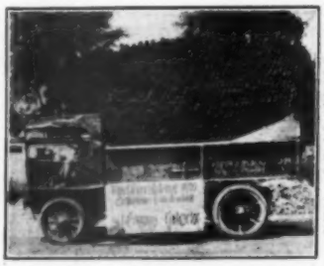

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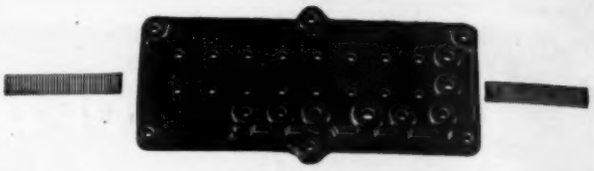

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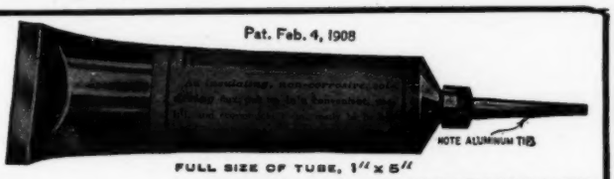

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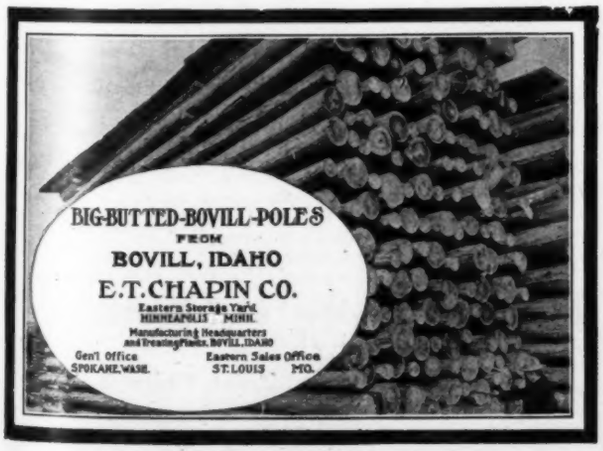

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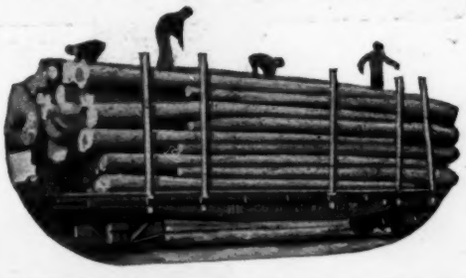

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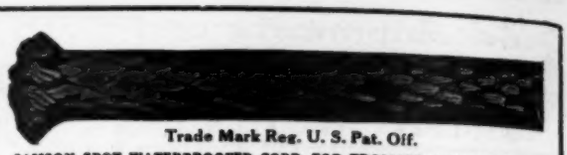

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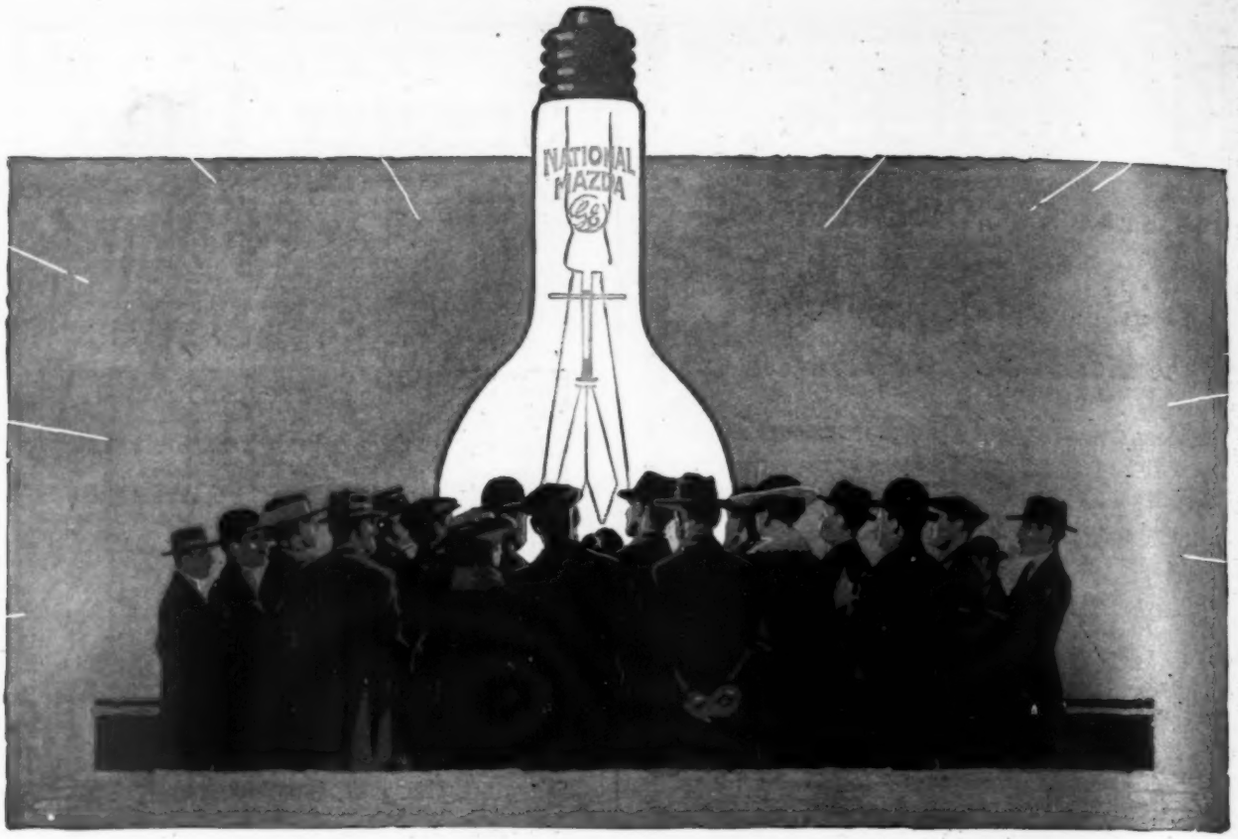

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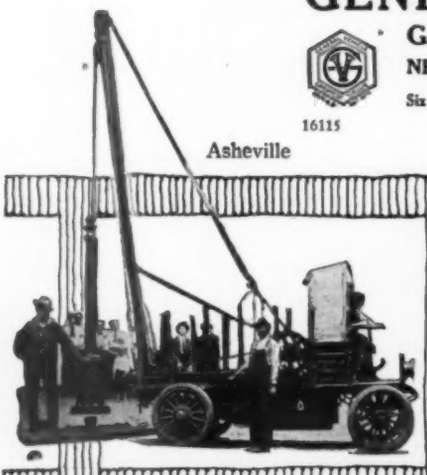

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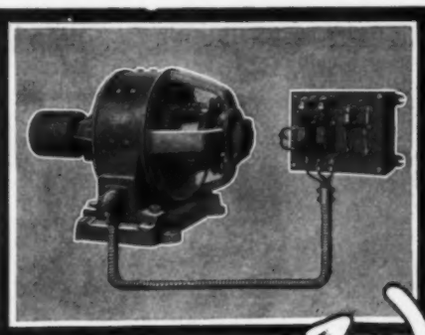

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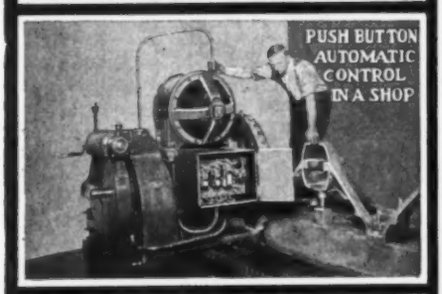

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Chicago Branch: 210 Desplaines St.
Chicago, Illinois

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Largest Manufacturers of Transformers Exclusively
in the United States
Pittsburgh, Pa.

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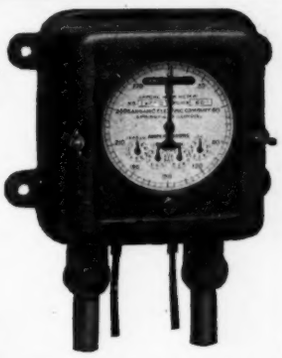
Porcelain and Wiring Appliances
made to order to specifications
Send drawing or model for estimate
PERU ELECTRIC CO.
PERU, IND.

SANGAMO
BUILT LIKE A WATCH

METERS for every Electrical need. Ask for Bulletins



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NEW YORK MINNEAPOLIS ROCHESTER LOS ANGELES

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Voltage Detectors

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High Voltage Specialties

SCHWEITZER & CONRAD, Inc.
1770 Berteau Avenue
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HIGH TENSION
STEEL TOWER OUTDOOR SUB-STATIONS
DELTA STAR ELECTRIC CO. CHICAGO
ICE PROOF POLE TOP P.M. SWITCHES
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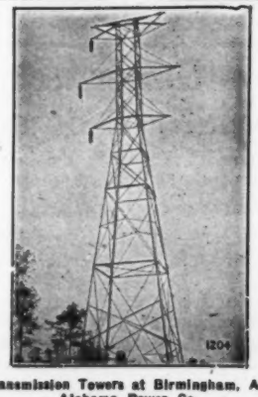
AMERICAN BRIDGE COMPANY
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS



Transmission Towers at Birmingham, Ala.
Alabama Power Co.

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Boston, Mass. . . John Hancock Bldg.
Baltimore, Md., Continental Trust Bldg.
PITTSBURGH, PA. . . Frick Building
Rochester, N. Y. . . . Powers Block
Buffalo, N. Y. . Marine National Bank
Cincinnati, Ohio. Union Trust Building
Atlanta, Ga. . . . Candler Building
Cleveland, Ohio . Rockefeller Building
Detroit, Mich., Beecher Ave. & M. C. R. R.
CHICAGO, ILL., 208 South La Salle St.
St. Louis, Mo., Third Nat'l Bank Bldg.
Denver, Colo., First Nat'l Bank Building
Salt Lake City, Utah, Walker Bank Bldg.
Duluth, Minn. . . . . Wolvin Building
Minneapolis, Minn., 7th Ave. & 2nd St., S. E.

Pacific Coast Representative:
U. S. Steel Products Co. Pacific Coast Dept.
SAN FRANCISCO, CAL., Rialto Building
Portland, Ore. . . . . Selling Building
Seattle, Wash., 4th Ave. So. Cor. Conn. St.

Export Representative:
United States Steel Products Co., 30 Church St., N. Y.

ELECTRICAL EXCHANGE

POSITION WANTED

The rate for "Positions Wanted" advertisements is two cents per word, minimum charge 50 cents an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical Review and Western Electrician, 608 So. Dearborn Street, Chicago, or 13-21 Park Row, New York.

POSITION WANTED—Electrical engineer, 34, married, technical education, eight years' practical training in motor application and salesmanship. Capable of making engineering reports and recommendations for electrical drive. Address No. 3039, Electrical Review and Western Electrician, Chicago.

HELP WANTED

The rate for "Help Wanted" advertisements is three cents a word, minimum charge $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

WANTED—Young technical graduates wanted for test floor work by a large manufacturer of electrical machinery. Broad training and exceptional opportunities for qualified men. Give full particulars regarding education and practical experience in first letter. Box No. 911, Pittsburgh, Pa.

WANTED—Several skilled electrical instrument makers, first-class men for instrument and meter calibration. Write fully, giving detailed experience and wages desired. Roller-Smith Company, Bethlehem, Pa.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements is three cents a word, minimum charge of $1.50 an insertion, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

WANTED—A 60-cycle, 150,000-volt, or any size up to 300,000-volt, testing transformer. Give price, description, and point of shipment. Address No. 3041, Electrical Review and Western Electrician, Chicago.

FOR SALE

RICE AND SARGENT ENGINE

Horizontal, simple non-condensing, releasing gear, belted type. Indicated horsepower, 280 at 25% cut-off; 375 at 60% cut-off. Cylinder 16-in., stroke 36-in., R. P. M. 120, steam pressure 130 lbs. Only six years old and in daily operation. If you can use this fine engine write at once to Address No. 3042, Electrical Review and Western Electrician, Chicago.

WILL PURCHASE A gas, electric or combination gas and electric property in small city. Write today, giving full particulars, to A-L, care Electrical Review and Western Electrician, 608 S. Dearborn St., Chicago.

America's Headquarters for

Second Hand Electrical Machinery

Overhauled in our shops and sent out "as good as new" with a satisfactory guarantee. We buy—sell—repair—rent and exchange—and are always ready for a trade. No quantity too large. Send for our "Monthly Bargain Sheet," showing net prices.

GREGORY ELECTRIC CO.

NATIONAL ELECTRICAL EXCHANGE
AURORA, ILL.

FOR SALE—220 V. Motors:—One each, 75 H. P.—15 H. P. and 3 H. P. 2 phase; also 20 H. P., 3 phase, all 60 cycle; 1-20 H. P. direct current.

GENERATING PLANT FOR SALE

550 D. C. generating plant, in first-class condition, which we will sell at a very low price, together with boiler, switchboard, and everything complete. M. K. Frank, Frick Bldg., Pittsburgh, Pa.

FOR SALE—Four 3½ H. P. direct load 500 Volt D. C., series wound fully enclosed standard Crocker Wheeler Crane motors, extra extension shaft, equipped with solenoid brake. Four 1½ H. P. 500 Volt D. C., series wound fully enclosed Standard Crocker-Wheeler Crane motors. These motors are in first-class shape. Will quote low figure for prompt disposition. Address, Geo. M. Ryall, 390 Pacific Electric Building, Los Angeles, Cal.

PROPOSALS

The rate for "Proposal" advertisements is fifteen cents per line, nonpareil measurement, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

TREASURY DEPARTMENT, Supervising Architect's Office, Washington, D. C., December 6, 1916.—Sealed proposals will be opened in this office at 3 p. m., January 4, 1917, for the remodeling of an electric passenger elevator in the United States post office and customhouse at Galveston, Tex., in accordance with the specification, copies of which may be had at this office in the discretion of the Supervising Architect. —James A. Wetmore, Acting Supervising Architect.

BOUSTEAD ELEC. & MFG. CO.
NEW AND USED ELECTRICAL MACHINERY
SWITCHBOARDS
ARMATURE AND TRANSFORMER WINDING
REPAIRING
215 1st Ave. North Minneapolis, Minn.

Use it to prevent cutting and sparking and to keep your commutators in good condition. It's the cheapest commutator insurance and the only article known that will prevent cutting. Absolutely will not gum the brushes.
50 cents per stick—$5.00 per dozen.
Free Sample Stick—Write
K. McLENNAN & CO., Sole Mfrs., 1751 W. 35th St., Chicago, Ill.

NEW AND USED
Electrical and Steam Equipment

Alternating and Direct Current Units, Belted Dynamos, Engines, Rotary Converters and Transformers, Motor Generator Sets, Motors, etc., always in stock. The largest manufacturers in the country are installing used apparatus and hundreds of them are among our regular customers. Write to us for some of their names and also for our latest list of apparatus on hand.

MacGovern & Company, Inc.
14 Liberty Street, New York, N. Y.

Turbo Generators
Immediate Delivery

Two Westinghouse Parsons 300 K.W. direct connected Turbo generators, 60 cycle, 3 phase, 440 volts, exciters on same shaft; 150 lbs. or 200 lbs. steam pressure.

Two Wheeler surface condensers. Brass tubes with brass lined air pumps mounted integral with condensers.

One 30 H.P. Induction Motor Generator Set, 440 volts, 3 phase, 60 cycle motor, 110 volts, 850 R. P. M. generator; 3 Panel Switchboard, one panel for each generator and one for exciter units, with appropriate instruments and wiring.

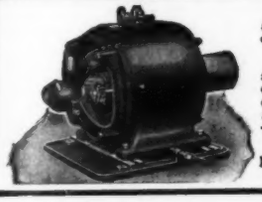
All piping, valves, etc., can be seen under steam at our plant

American Hoist and Derrick Co., St. Paul, Minn.

To avoid delays, the telephone user should always look up the number wanted in the telephone directory before taking the receiver from the hook.

AMERICAN TELEPHONE & TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

One Policy *One System* *Universal Service*



Glad to Take Up With You
any questions involving the use of the right dynamos in the right places.

Eck Dynamos
are conservatively rated, honestly constructed, fully guaranteed, have a 12 years' record of successful performance behind them, and may be had in 30 different frame types —.035 to 15 k. w.

Send for Bulletin No. 39.

Eck Dynamo and Motor Co.
Belleville, N. J.

ALTERNATORS
Vertical Type

67% Larger Income—Same Cost. For direct coupling to water-wheel shafts for Power and Lighting Service. 20 K.W. to 1,000 K.W.

Electric Machinery Company
Minneapolis - - Minn.

THE BABCOCK & WILCOX COMPANY, 85 Liberty St., NEW YORK
BABCOCK & WILCOX, STIRLING, RUST

WATER TUBE STEAM BOILERS

Steam Superheaters — WORKS: BAYONNE, N. J., BARBERTON, OHIO. — Mechanical Stokers

BRANCH OFFICES

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PHILADELPHIA, North American Building
PITTSBURGH, Farmers' Deposit Bank Bldg.
SAN FRANCISCO, Sheldon Building
NEW ORLEANS, Shubert Arcade.
DENVER, 435 Seventeenth Street
SALT LAKE CITY, 313 Atlas Block
CHICAGO, Marquette Building
ATLANTA, GA., Candler Building
CLEVELAND, New England Building
CINCINNATI, O., Traction Building
SEATTLE, Mutual Life Building
HAVANA, CUBA, 116½ Calle de la Habana
LOS ANGELES, American Bank Building

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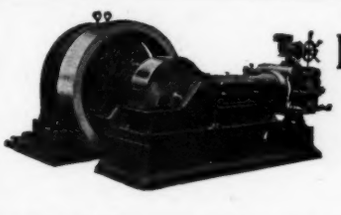


High Efficiency Power Equipment

THE point in question with every purchase of new equipment is to determine upon the engine which will in its performance, produce day after day, without extreme care or attention, the maximum of efficiency, and with a low cost of upkeep and operation.

Ridgway Units give you all this and more.

Ridgway Dynamo & Engine Company
Ridgway, Pa.

Commonwealth Edison Company
Repair Shops

High grade machine work of all kinds—Dynamos, Motors, Transformers, Arc Lamps and Appliances

'Phone Randolph 1280—Correspondence Solicited
38 North Market Street, Chicago

405

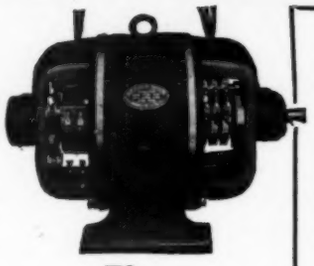
Power Solicitors

Wagner, Quality Motors

If you want power, satisfaction, continuity of service for your customers, see that they specify,
Wagner, Quality Motors

Have you seen motor Bulletins 1105 and 1115?

Wagner Electric Manufacturing Company,
Saint Louis, Missouri 388



The
"MARTIN"
Rotary Converter

For Real
"Sun-Lit" Pictures
and Perfect Reel Dissolving

Two arcs can be burned simultaneously and reels dissolved into each other without the starting of the second arc disturbing the light on the picture being projected by the first.

The placing of the converter in base of panel board makes it a self-contained outfit and cuts the wiring and installation cost in half.

Write for full information

Northwestern Electric Co.
613-615 West Adams Street
Chicago, Illinois
1457 Broadway
New York, N. Y.

PEERLESS A. C. Motors

are remarkable for their satisfactory service. Built right—strong—durable—entire satisfaction guaranteed.

PEERLESS Low Voltage Generators

for individual house and farm lighting are highly efficient. Literature on request.

The Peerless Electric Co.
Warren, Ohio

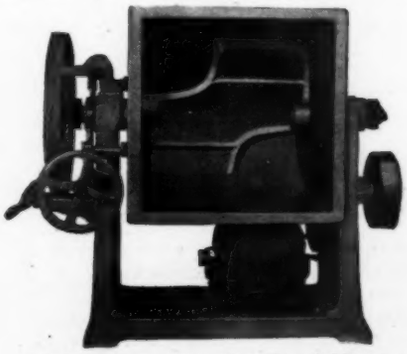
CHICAGO SALES AGENTS
The Electrical Machinery Sales Co.
836 Webster Bldg.

The uniformly satisfactory results obtained from the thousands of

Century

Repulsion Start-Induction SINGLE PHASE MOTORS

driving bakery machinery are due among other reasons to the fact that the short circuiting mechanism slides into contact thereby cleaning the contact surface of flour dust.



7½ H. P. Motor Geared to a Dough Mixer

1/10 to 40 H. P.—25 to 140 Cycles.
THEY KEEP-A-RUNNING

Century Electric Company
19th, Pine to Olive Streets St. Louis. Mo., U. S. A.
Sales Offices in Principal Cities 199

CROCKER-WHEELER

LIKE THE PYRAMIDS

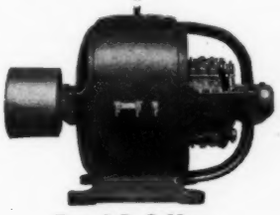
BUILT TO LAST

Motors, Generators, Transformers, In All Sizes, In All Types, For All Purposes.

EFFICIENCY and ECONOMY

The most efficient motor is the one that delivers the greatest power with the least consumption of electric current.

The most economical motor is the one that gives the greatest service at the least cost.



Form I, D. C. Motor

An efficient motor may not be economical. It may save a penny or two in the cost of current, but this apparent saving may be more than offset by the cost of repairs and replacements to say nothing of interrupted production, idle investment, etc.

DEMAND ECONOMY when buying motors. Economy means efficiency and service. Make the first cost of your motors the last cost. Insist on **CROCKER-WHEELER** "Built To Last" motors. They are *Economical, Efficient, Reliable, Durable.*

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CLEVELAND
DENVER
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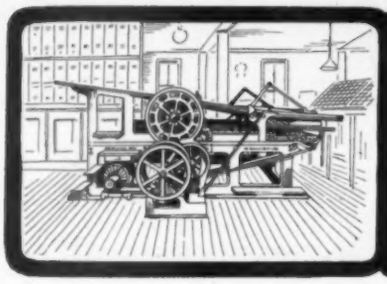
NEW YORK
PHILADELPHIA
PITTSBURG
ST. PAUL
SAN FRANCISCO
SYRACUSE



Publisher to Reader

The Issue of January 6

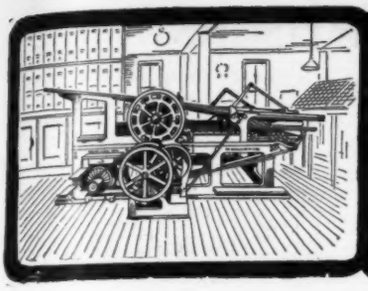
December 31 marks the close of what has been a most eventful year in the electrical industry. Previous records of accomplishment have been shattered and new records established.

The development of 1916 has been, to a very large degree, one sided. That is, the commercial development has greatly overshadowed the technical and scientific advances. Nevertheless, engineering progress has been made and the year 1916 is notable for many significant and far-reaching developments that are of interest to the entire industry.

It is with a full realization of the unique condition hastily sketched above that the issue of January 6 has been planned. The review for 1916 in each branch of the industry has been prepared by men universally considered authorities in their respective fields. For instance, Dr. Louis Bell will review the developments during 1916 in electric lighting; Mr. Peter Junkersfeld, the central-station field; Prof. A. M. Buck, electric traction; Mr. Ernest Freeman, electrical contracting; Prof. Thompson, electro-chemistry; Mr. Frank F. Fowle, telephony and telegraphy; Mr. P. E. Edelman, wireless, etc.

There will also be several other features of unusual and timely interest, making the issue of January 6 of permanent and significant value to the industry.

ELECTRICAL REVIEW
AND
WESTERN ELECTRICIAN
608 South Dearborn St.
CHICAGO



Publisher to Reader

Plans for 1917

As the electrical industry has passed through the most eventful year in its history, so the **Electrical Review and Western Electrician** has completed a most successful year in service rendered to its subscribers.

In 1917 there will be a continuation of this service based on the realization that to a much greater extent than ever before the industry will require a Business Weekly that will measure up to the standards that will characterize 1917.

Our facilities in every direction have been increased and no expense will be spared during the coming year to fulfill our obligations to our readers.

ELECTRICAL REVIEW AND WESTERN ELECTRICIAN

608 South Dearborn St.
CHICAGO

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Benjamin Electric Mfg. Co.
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Faries Mfg. Co.
General Electric Co.
Harvey Hubbell, Inc.
Ward Leonard Electric Co.

ADJUSTERS, Cord and Lamp.
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Trumbull Electric Mfg. Co.

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General Electric Co., Ft. Wayne Dept.
Wagner Elec. Mfg. Co.
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Fairbanks, Morse & Co.
General Electric Co.
Wagner Elec. Mfg. Co.
Ward-Leonard Electric Co.
Westinghouse Electric & Mfg. Co.
Western Electric Co.

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General Vehicle Co.

AUTOMOBILE LIGHTING SYSTEMS.
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Wagner Elec. Mfg. Co.
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co.

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American Bridge Co.

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Pass & Seymour, Inc.

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Fairbanks, Morse & Co.
Manhattan Electrical Supply Co.
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Western Electric Co.

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Ostrander & Co., W. R.

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Fairbanks, Morse & Co.

BATTERIES, Wet.
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Co.

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Emerson Electric Mfg. Co.
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Sprague Electric Works.

BLOWERS, Organ.
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BOLTS, EXPANSION.
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Hart Mfg. Co.
Metropolitan Engineering Co.
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Phelps, James C.
Sprague Electric Works.
Steel City Electric Co.
Thomas & Betts Co.

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Electrical Engineers Equipment Co.
General Electric Co.
Manhattan Electrical Supply Co.
Steel City Electric Co.
Thomas & Betts Co.

BOXES, Manhole.
Columbia Metal Box Co.
D & W Fuse Co.
General Electric Co.
Metropolitan Engineering Co.
Standard Underground Cable Co.

BOXES, Service, Sheet Steel and Cast Iron Entrance Boxes and Panelboard Cabinets.
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Brady, T. H.
C. & P. Electric Works.
Columbia Metal Box Co.
Cutter Co., George.
D & W Fuse Co.
Delta-Star Electric Co.
General Electric Co.
Metropolitan Engineering Co.
Palmer Elec. & Mfg. Co.
Standard Underground Cable Co
Trumbull Electric Mfg. Co.
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BRACES, Cross Arm.
Hubbard & Co.

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Faries Mfg. Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.

BRACKETS, Pothead.
Electrical Engineers' Equipment Co.

BRAKES, Dynamo.
Cutler-Hammer Mfg. Co.

BRAKES, Electric.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sundh Electric Co.
Western Electric Co.

BRAKES, Motor.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
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Electrical Engineers' Equipment Co.
Hickey & Schneider.

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General Electric Co.
National Metal Molding Co.
Phelps, James C.
Sprague Electric Works.
Steel City Electric Co.
Thomas & Betts Co.

BUSHINGS, Porcelain Clamping.
General Electric Co.
Pass & Seymour, Inc.

BUSHINGS, Socket.
Hemming Mfg. Co.
Hubbell, Inc., Harvey.
Mechanical Rubber Co.
Western Electric Co.

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American Steel & Wire Co.
American Insulated Wire & Cable Co.
Atlantic Insulated Wire & Cable Co.
Belden Mfg. Co.
Central Electric Co.
Electric Cable Co.
General Electric Co.
Habirshaw Wire Co.
Hazard Mfg. Co.
Indiana Rubber & Ins. Wire Co.
Kerite Insulated Wire & Cable Co.
Moore, Alfred F.
National Conduit & Cable Co.
Okonite Co., The.
Roebling's Sons Co., John A.
Safety Insulated Wire & Cable Co.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE BELLS.
Electrical Engineers' Equipment Co.

CABLE HANGERS.
Anderson Mfg. Co., Albert & J. M.
Hubbard & Co.
Metropolitan Engineering Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE RACKS.
Cope, T. J.
Electrical Engineers' Equipment Co.
General Electric Co.
Metropolitan Engineering Co.
Standard Underground Cable Co.

CABLE TERMINALS.
Standard Underground Cable Co.

CABLE TESTERS.
Metropolitan Engineering Co.
Roller-Smith Co.
Standard Underground Cable Co

CABLES, Armored. (Flexible.)
National Metal Molding Co.
Sprague Electric Works.
Standard Underground Cable Co.
Western Conduit Co.

CABLING MACHINES.
New England Butt Co.

CALIBRATORS, Meter.
General Electric Co., Ft. Wayne Dept.
Roller-Smith Co.

CANOPY INSULATORS.
Faries Mfg. Co.
General Electric Co.
Mica Insulator Co.

CARBONS, Arc Light.
Central Electric Co.
General Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg Co.

CARBONS, Battery.
Manhattan Electrical Supply Co

CAR HEATING, Electric.
Simplex Electric Heating Co.
Western Electric Co.

CARS, DERRICK.
American Bridge Co.

CASTINGS.
Anderson Mfg. Co., Albert & J. M.
New England Butt Co.

CEMENT MACHINERY.
Allis - Chalmers Manufacturing Co.

CHANDELIERS.
Beardslee Chandelier Mfg. Co.
Central Electric Co.
Faries Mfg. Co.

CHANGERS, Inc. Lamp.
McGill Mfg. Co.

CHARGING OUTFITS.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

CHOKE COILS.
Anderson Mfg. Co., Albert & J. M
Delta-Star Electric Co.
General Electric Co.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.
Ward Leonard Electric Co.
Westinghouse Electric & Mfg Co.

CIGAR LIGHTERS.
General Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CIRCUIT BREAKERS, Automatic.
Cutler-Hammer Mfg. Co.
Cutter Co.
Electric Controller & Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Roller-Smith Co.
Sundh Electric Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CLAMPS, Cable Supporting.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.

CLAMPS, FLEXIBLE TUBING.
Delta-Star Electric Co.

CLAMPS, Insulator.
Clark Electric & Mfg. Co.
Electrical Engineers Equipment Co.
Hickey & Schneider.
Steel City Electric Co.

CLEATS, Fibre.
Blake Signal & Mfg. Co.
General Electric Co.

CLEATS, Insulating.
Hemming Mfg. Co.
Minerallac Electric Co.

CLIMBERS, Linemen's.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Western Electric Co.

CLOTH, Insulating.
Mica Insulator Co.
Mechanical Rubber Co.

CLUSTERS.
Benjamin Electric Mfg. Co.
Central Electric Co.
Delta-Star Electric Co.
Faries Mfg. Co.
McGill Mfg. Co.
Western Electric Co.

COAL MINING MACHINERY.
Allis - Chalmers Manufacturing Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

COILS.
Acme Wire Co.
American Electrical Works.
Belden Mfg. Co.
Crocker-Wheeler Co.
D & W Fuse Co.
General Electric Co.
Handy Supply Co.
Hickey & Schneider.
Ostrander & Co., W. R.
Ward-Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg Co.

CLASSIFIED INDEX—Continued

COMMUTATOR LUBRICANTS.
Allen Co., Inc., L. B.
Handy Supply Co.
McGill Mfg. Co.
McLennan & Co., K.

CONDENSERS, Electric.
Leeds & Northrup Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CONDENSERS, Steam.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
Westinghouse Machine Co.

CONDUIT RODS.
Standard Underground Cable Co.
Western Electric Co.

CONDUIT, Interior.
Alphaduct Co.
American Circular Loom Co.
Central Electric Co.
Clifton Mfg. Co.
Enameled Metals Co.
National Metal Molding Co.
Tubular Woven Fabric Co.
Western Conduit Co.
Western Electric Co.

CONDUIT, Underground, Clay, Composition, Fibre, Wood.
American Conduit Co.
Camp Co., H. B.
Fibre Conduit Co.
National Fireproofing Co.

CONDUIT ENGINEERS & CONTRACTORS.
Gest, G. M.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

CONDUIT FITTINGS.
Killark Electric Mfg. Co.

CONDUIT THREADERS.
Delta-Star Electric Co.

CONNECTORS.
Clark Electric & Mfg. Co.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
Metropolitan Engineering Co.
Mueller & Co., R. S.
Ohio Brass Co.

CONSTRUCTION, Engineering.
Arnold Co.
Baehr, Wm. A.
Byllesby & Co., H. M.
Electrical Engineers' Equipment Co.
New England Butt Co.
Stone & Webster Eng. Corp.
White Companies, J. G.

CONTROLLERS, AUTOMATIC, for Automobile Lighting Systems.
Ward-Leonard Electric Co.

CONTROLLERS, Printing Press.
Allis-Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co.

CONVERTERS, ROTARY.
Fairbanks, Morse & Co.
General Electric Co.
Northwestern Electric Co.

COOKING DEVICES, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Globe Stove & Range Co.
Hughes Electric Heating Co.
Manhattan Electrical Supply Co.
Ruvio Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

COPPERS, Battery.
Manhattan Electrical Supply Co.
Western Electric Co.

CORD, Braided.
Samson Cordage Works.

CRANES AND HOISTS.
Allis-Chalmers Manufacturing Co.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
Sprague Electric Works.

CRANE MOTORS.
Crocker-Wheeler Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CROSS ARMS (Wood).
American Bridge Co.
Lindsley Brothers Co.

CURLING IRONS, Electric.
Central Elec. Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Enclosed Fuse, Plug, Combination Rosette, Cut-Out Bases.
Bryant Electric Co.
C. & P. Electric Works.
Central Electric Co.
Chicago Fuse Mfg. Co.
Commonwealth Edison Co.
D & W Fuse Co.
General Electric Co.
Hart Mfg. Co.
Manhattan Electrical Supply Co.
Trumbull Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co.
Bryant Electric Co.
Cutter Co., George.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Metropolitan Engineering Co.

CUT-OUTS, Transformer.
Central Electric Co.
D & W Fuse Co.
General Electric Supply Co.
Delta-Star Electric Co.
General Electric Co.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

DAMS, MOVABLE.
American Bridge Co.

DECORATIVE LIGHTING.
Central Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.

DERRICKS.
American Bridge Co.

DIRECT MOTOR DRIVES.
Crocker-Wheeler Co.
Electric Machinery Co.
Electric Controller & Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
Roth Bros. & Co.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

DOOR SWITCHES.
Cutler-Hammer Mfg. Co.
Hart Mfg. Co.

DRILLS AND BITS, Electricians'.
Morse Twist Drill & Machine Co.
Hubbard & Co.

EGG COOKERS.
Ruvio Electric Co.

ELECTRIC VEHICLES.
General Vehicle Co.

ELECTRO-PLATING MACHINERY.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Sprague Electric Works.
Westinghouse Electric & Mfg. Co.

ENGINEERS & CONTRACTORS
American Bridge Co.
Arnold Co.
Baehr, Wm. A.
Badt-Westburg Electric Co.
Byllesby & Co., H. M.
Jackson, D. C. & W. B.
Lyndon, Lamar.
McMeen & Miller.
Norton, Bird & Whitman.
Pillsbury, Chas. A
Sargent & Lundy.
Stone & Webster Engineering Corporation.
Western Electric Co.
White Companies, J. G.
Woodmansee & Davidson, Inc.

ENGINES, Gas and Gasoline.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
Westinghouse Machine Co.

ENGINES, OIL.
Fairbanks, Morse & Co.

ENGINES, Steam.
Allis-Chalmers Manufacturing Co.
Murray Iron Works Co.
Ridgway Dynamo & Engine Co.
Westinghouse Machine Co.

FANS, Motor and Disc.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Hunter Fan & Motor Co.
Manhattan Electrical Supply Co
Peerless Electric Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FAULT FINDERS, Electric.
Electric Controller & Mfg. Co.

FIBRE.
Continental Fibre Co.
Diamond State Fibre Co.

FIRE ALARMS.
Palmer Electric & Manufacturing Co.

FIREPLACES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.
Adapti Co., The.
Killark Electric Mfg. Co.
National Metal Molding Co.
Phelps, James C.
Sprague Electric Works.

FIXTURES, Electric and Gas.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Co.
Central Electric Co.
Delta-Star Electric Co.
Faries Mfg. Co.
Moran & Hastings Mfg. Co.
Robert Findlay Mfg. Co., Inc.
Western Electric Co.

FIXTURES, Indirect and Semi-Indirect Lighting.
Beardslee Chandelier Mfg. Co.
Central Electric Co.
General Electric Co.
Moran & Hastings Mfg. Co.
Robert Findlay Mfg. Co., Inc.

FIXTURES, Show Case.
Benjamin Electric Mfg. Co.
Central Electric Co.
Johns-Manville Co., H. W.

FLASHERS, Sign.
Campbell Electric Co.

FLASHLIGHTS.
Delta-Star Electric Co.

FLAT IRONS, Electric.
Central Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
International Electric Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FLUXES, Soldering.
Allen Co., Inc., L. B.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Chicago Fuse Mfg. Co.
McGill Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

FORGINGS.
American Bridge Co.

FUSE PLUGS.
Anderson Mfg. Co., Albert & Atlas Selling Agency.
Bryant Electric Co.
D & W Fuse Co.
Daum, A. F.
General Electric Co.
Stanley & Patterson.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FUSE WIRE.
Chicago Fuse Mfg. Co.
General Electric Co.
Western Electric Co.

FUSES.
Bryant Electric Co.
Central Electric Co.
Chicago Fuse Mfg. Co.
D & W Fuse Co.
Daum, A. F.
Delta-Star Electric Co.
Economy Fuse & Mfg. Co.
Electrical Engineers Equipment Co.
Federal Sign System (Electric).
General Electric Co.
Hickey & Schneider.
Metropolitan Engineering Co.
Schweitzer & Conrad, Inc.
Star Fuse Co.
Westinghouse Electric & Mfg. Co.

GATES, HEAD.
American Bridge Co.

GEARS, Rawhide and Composition.
Diamond State Fibre Co.
General Electric Co.
New Process Gear Corp.

GENERATORS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Ridgway Dynamo & Engine Co.
Star Dynamo Co
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

GLASSWARE, Illuminating.
Central Electric Co.
Ivanhoe-Regent Works of General Electric Co.
Western Electric Co.

GLOBES, Arc Light. (Outer and Inner.)
General Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

GRATES.
Murray Iron Works Co.

GROUND CLAMPS.
General Electric Co.
Hart Mfg. Co.
Hubbard & Co.
Sprague Electric Works.
Thomas & Betts Co.
Western Electric Co.

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co.
Hubbell, Inc., Harvey.
McGill Mfg. Co.

GUY CLAMPS.
American Steel & Wire Co.
Hubbard & Co.

HAIR DRYERS, Electric.
Shelton Electric Co.

HANGERS, Conduit and Moulding.
Western Electric Co.

HANGERS AND CLAMPS.
Ohio Brass Co.
Ostrander & Co., W. R.
Sprague Electric Works.
Standard Underground Cable Co.
Steel City Electric Co.
Thomas & Betts Co.

HEATERS, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Lee Electric Radiator Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

HEATERS, Water.
Bridgeport Electric Mfg. Co.

HEATING SYSTEMS, Exhaust Steam.
American District Steam Co.

HOISTING MACHINERY, Electric Mine.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
General Electric Co.

HYDRAULIC MACHINERY.
Allis-Chalmers Manufacturing Co.

INCLINATORS, CARBOY
McCord & Co., Horace.

INSTRUMENTS.
Bristol Co.
Electric Controller & Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Leeds & Northrup Co.
Manhattan Electrical Supply Co.
Metropolitan Engineering Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Wagner Elec. Mfg. Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.

INSULATING CEMENTS.
Mechanical Rubber Co.
Westinghouse Electric & Mfg. Co.

INSULATING MACHINERY.
Hubbell, Inc., Harvey.
New England Butt Co.

INSULATING PAINTS AND COMPOUNDS.
Chicago Mica Co.
Electrical Engineers Equipment Co.
McGill Mfg. Co.
Mechanical Rubber Co.
Mica Insulator Co.
Sherwin-Williams Co.
Standard Paint Co.
Standard Underground Cable Co
Ward Leonard Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATION, Hard Rubber Composition, Etc.
Continental Fibre Co.
Electrose Mfg. Co.
Hemming Mfg. Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Arc Lamp.
Anderson Mfg. Co., Albert & J. M.
Cutter Co., George.
General Electric Co.
Ohio Brass Co.
Westinghouse Electric & Mfg Co.

INSULATORS, Glass.
General Electric Co.
Hemingray Glass Co.
Locke Insulator Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, High Voltage.
Electrical Engineers' Equipment Co.
Electrose Mfg. Co.
General Electric Co.

CLASSIFIED INDEX—Continued

Locke Insulator Mfg. Co.
Ohio Brass Co.
Thomas R., & Sons Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Wood.
Westinghouse Electric & Mfg. Co.

INSULATOR SUPPORTS.
Clark Electric & Mfg. Co.
Hickey & Schneider.

INSURANCE.
Utilities Fire and Liability Indemnity Exchanges.

IRIDIO-PLATINUM.
Baker & Co., Inc.

JARS, Battery (Glass).
Hemingray Glass Co.

JOINTS, Cable.
General Electric Co.

JOINTS, Fixture Insulating.
Faries Mfg. Co.
Thomas & Betts Co.

LAMP REGULATORS, INCANDESCENT.
Anylite Electric Regulator Co.

LAMPS, Arc.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LAMPS, Incandescent.
Anchor Electric Co.
Central Electric Co.
Deuth & Co., Inc.
Edison Lamp Works of General Electric Co.
Franklin Electric Mfg. Co.
Hubbell, Inc., Harvey.
Lux Mfg. Co.
National Lamp Works of General Electric Company, comprising the following member divisions:
American Electric Lamp Division.
Banner Electric Division.
Boston Economy Lamp Division.
Brilliant Electric Division.
Bryan-Marsh Electric Division.
Buckeye Electric Divison.
Colonial Electric Division.
Columbia Incandescent Lamp Division.
Economical Electric Lamp Division.
Elux Miniature Lamp Division.
Federal Miniature Lamp Division.
Fostoria Incandescent Lamp Division.
General Incandescent Lamp Division.
Monarch Incandescent Lamp Division.
Munder Electric Division.
Packard Lamp Division.
Peerless Lamp Division.
Shelby Lamp Division.
Standard Electric Division.
Sterling Electric Lamp Division.
Sunbeam Incandescent Lamp Division.
New York Electric Lamp Co.
Western Electric Co.
Westinghouse Lamp Co.

LAMPS, MINIATURE.
Mannweiler Co., A. C.

LAMPS, Vapor and Vacuum Tube.
General Electric Co.

LANTERNS.
Manhattan Electrical Supply Co.

LIGHTING PLANTS.
Crocker-Wheeler Co.
Fairbanks, Morse & Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
Delta-Star Electric Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Railway and Industrial Engineering Co.
Schweitzer & Conrad, Inc.
Westinghouse Electric & Mfg. Co.

LIGHTS, Desk.
Faries Mfg. Co.

LIGHTS, Stage.
General Electric Co.

LINE MATERIALS.
Anderson Mfg. Co., Albert & J. M.
Central Electric Co.
General Electric Co.
Hubbard & Co.
Ohio Brass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LOCKS, Meter.
Acme Electric Meter Lock Co.

LOCOMOTIVES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LUGS.
Chicago Fuse Mfg. Co.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
General Electric Co.
Trumbull Electric Mfg. Co.

MAGNETIC SWITCH CONTROLLERS.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sundh Electric Co.
Westinghouse Electric & Mfg Co.

MAGNETOS, MAGNETO-GENERATORS AND BELLS.
Manhattan Electrical Supply Co.
Western Electric Co.

MAGNETOS, Ignition.
General Electric Co.
Manhattan Electrical Supply Co.

MAGNETS, Electro.
Acme Wire Co.
Belden Mfg. Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Manhattan Electrical Supply Co.
Sundh Electric Co.
Ward Leonard Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Sundh Electric Co.
Western Electric Co.

MAGNETS, Permanent.
Western Electric Co.

MARINE FIXTURES.
Benjamin Electric Mfg. Co.
Delta-Star Electric Co.
General Electric Co.

MAST ARMS.
Brady Electric Mfg. Co.
Cutter Co., George.
General Electric Co., Ft. Wayne Dept.
Pittsburgh Transformer Co.

MEASURING MACHINES (For Wire Measuring).
Minneapolis Electric & Construction Co.
New England Butt Co.

MEDICAL APPARATUS.
Bleadon-Dunn Co.

METAL FITTINGS.
Peru Electric Co.

METERS, Recording.
Bristol Co.
General Electric Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Westinghouse Electric & Mfg. Co.

MICA.
Chicago Mica Co.
Mica Insulator Co.

MINING MACHINERY (Motor Driven).
Allis - Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

MOLDED INSULATION.
Cutler-Hammer Mfg. Co.
Hemming Mfg. Co.
Westinghouse Electric & Mfg. Co.

MOTORS AND DYNAMOS.
Advance Electric Co.
Allis-Chalmers Manufacturing Co.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Emerson Electric Mfg. Co.
Fairbanks, Morse & Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Peerless Electric Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Sprague Electric Works.
Star Dynamo Co.
Wagner Electric Mfg. Co.
Warner Electric Co., R. P.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Wisconsin Electric Co.

MOULDING.
American Conduit Mfg. Co.
National Metal Molding Co.
Trumbull Electric Mfg. Co.

OZONIZERS.
General Electric Co.

PACKING, Steam.
New York Insulated Wire Co.

PAINTS, Preservative.
Standard Paint Co.
Mechanical Rubber Co.

PAPER, Insulating Paper, Fuller Board, Press Board.
Diamond State Fibre Co.
Mechanical Rubber Co.

PATENT SOLICITORS.
Duvall, Edw. S.
Howe, Thomas.
Siggers, E. G.

PHOTOMETERS, Lamp Testing.
Leeds & Northrup Co.

PHOTOMETER STANDARDS.
Electrical Testing Laboratories.

PIGTAILS AND FLEXIBLE LEADS.
Belden Mfg. Co.
Rome Wire Co.

PINS AND BRACKETS, Wood.
Electrical Engineers' Equipment Co.
Ohio Brass Co.

PIPE COVERINGS, STEAM.
American District Steam Co.

PLATFORMS (Pole Seats).
Hubbard & Co.
Oshkosh Mfg. Co.

PLATINUM.
American Platinum Works.
Baker & Co., Inc.

PLIERS, Wire Cutting.
Bryant Electric Co.
Klein & Sons, Mathias.

PLUGS AND RECEPTACLES, Flush.
Bryant Electric Co.
Cutler-Hammer Mfg. Co.
Delta-Star Electric Co.
General Electric Co.
Hart Mfg. Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Trumbull Electric Mfg. Co.

PLUGS AND RECEPTACLES, Power.
Central Electric Co.

PLUGS AND RECEPTACLES, Stage.
Bryant Electric Co.
General Electric Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Western Electric Co.

POLES, Concrete.
American Steel & Wire Co.

POLES, Steel.
American Bridge Co.

POLES, Treated.
Bell Lumber Co.
Chapin, E. T., Co.
Crawford Cedar Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co
Page & Hill Co.
Partridge Lumber Co., T. M.
Sterling & Son Co., W. C.
Valentine-Clark Co.

POLES, Wood.
Bell Lumber Co.
Carney & Co., B. J.
Chapin, E. T., Co.
Crawford Cedar Co.
Duluth Log Co.
Fowler Co., John H.
Humbird Lumber Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co.
Northern White Cedar Ass'n.
Page & Hill Co.
Partridge Lumber Co., T. M.
Sterling & Son Co., W. C.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.
Western Red Cedar Ass'n.

POLE STEPS.
American Steel & Wire Co.
Anderson Mfg. Co., Albert & J. M.
Cutter Co., George.
Hubbard & Co.
Oshkosh Mfg. Co.

PORCELAIN, Special Shapes.
Cook Pottery Co.
Findlay Electric Porcelain Co.
General Porcelain Co
Hartford Faience Co.
Illinois Electric Porcelain Co.
Parker & Sons, J. H.
Peru Electric Co.
Thomas, R., & Sons Co.
Westinghouse Electric & Mfg. Co.

PORCELAIN, Standard.
Cook Pottery Co.
General Electric Co.
General Porcelain Co.
Hartford Faience Co.
Illinois Electric Porcelain Co.
Locke Insulator Mfg. Co.
Ohio Brass Co.
Thomas, R., & Sons Co.
Westinghouse Electric & Mfg. Co.

PORTABLES, Electric Reading Lamps.
Central Electric Co.
Faries Mfg. Co.
Herwig Art Shade & Lamp Co.

POSTS, Lamp.
Central Electric Co.
Cutter Co., George.
Delta-Star Electric Co.
Metropolitan Engineering Co.
Mohrlite Co.

POTENTIOMETERS.
Leeds & Northrup Co.

POTHEADS AND SLEEVES.
Brady Electric Mfg. Co.
Central Electric Co.
Delta-Star Electric Co.
Electrical Engineers' Equipment Co.
General Electric Co.
Okonite Co., The.
Schweitzer & Conrad, Inc.
Standard Underground Cable Co.

POWER HOUSE SPECIALTIES.
Electrical Engineers Equipment Co.

PRODUCERS, Gas.
Allis-Chalmers Manufacturing Co.
Fairbanks, Morse & Co.
Westinghouse Machine Co.

PROJECTORS, Electric. (Search Lights.)
General Electric Co.
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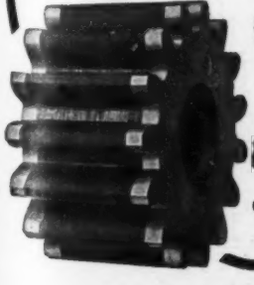

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